BASELINE RISK ASSESSMENT AND GROUNDWATER QUALITY REPORT

3126 Brinkerhoff Road, Kansas City, Kansas

Prepared by:

Cyrus B. Parks, Environmental Engineer
Union Carbide Corporation
Health, Safety, and Environmental Technology
P.O. Box 8361
South Charleston, WV 25303

Reviewed by:

Dr. K.C. Lee, Senior Research Scientist
(above address)

D.H. Ott
Operations and Environmental Affairs Manager
(below address)

Submitted by:

UNISON Transformer Services, Inc.
7401 Carmel Executive Park, Suite 206
Charlotte, NC 28226

September, 1994

UNISON

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TOXICS AND PESTICIDES BRANCH
TOXICS SUBSTANCE CONTROL SECTION

September 14,1994

Mr. Dennis Grams
Regional Administrator
United States EPA, Region VII
726 Minnesota Ave.
Kansas City, Kansas 66101

Re: Unison Transformer Services, Inc.: EP ID No. KSD980688733
Submittal of Risk Assessment: TSCA Closure Site at Brinkerhoff Rd., Kansas City,KS

Dear Mr. Grams:

Unison Transformer Services, Inc.(Unison) has been conducting site closure activities under an EPA approved TSCA closure plan at the subject facility since early 1992. Significant remediation work was necessary, and has been completed, primarily to meet PCB clean-up criteria. Unison has kept EPA informed of progress through communication with Mr. Robert Jackson of the Toxic Substances Control Section.

As a brief overview of the remediation status at the Brinkerhoff site, most of the activity has been associated with the removal of the concrete floor inside the building and the underlying soil to a nominal depth of two feet. Overall, nearly 2700 tons of PCB contaminated material has been removed and landfilled in an EPA approved TSCA landfill. The entire site encompasses 32000 square feet, including the outside parking lot areas. Sample results obtained in accordance with the approved EPA sample protocol show that, with the exception of an isolated area (about 500 sq ft) inside the building, the site meets the clean-up criteria for PCB. During closure activities, this small isolated area was discovered to be contaminated with both trichloroethylene (TCE) and PCB. About 500 tons of the removed soil underlying this area was treated to remove TCE prior to landfilling. This activity has been completed, but not all sample results under the established protocol for TCE and PCB meet the clean-up criteria at the bottom of the excavation some twenty feet below the original floor. Safety concerns and structural risks to the building limited the practical extent of the excavation.

Unison has developed and conducted the enclosed formal site study and risk assessment to address the possible impact of the small amount of residual contamination that remains in the isolated area about twenty feet below the original grade level of the site. As detailed in the report, site remediation as currently completed eliminates any significant health and environmental risk related to the presence of residual TCE or PCB. Therefore, the attached "Baseline Risk Assessment and Groundwater Quality Report" is being submitted by Unison to EPA for consideration in gaining final Agency approval for closure and release from the requirements for financial assurance.

Your prompt attention to this submittal is appreciated. Unison would be willing to meet with appropriate EPA representatives to discuss any aspects of the risk assessment or the closure status in general. Please direct any questions or requests to me at 704-541-4430.

Sincerely,

R.A. Ream

R.A.Ream
Vice President of Operations
Unison Transformer Services, Inc.
P.O.Box 471008
Charlotte, NC 28247

Copies: Robert Jackson, US EPA VII
M.S.Liggatt, Unison
D.H.Ott, Unison

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

SUMMARY OF FINDINGS

UNISON Transformer Services, Inc., entered into a facility operating agreement with Envirosure, Inc., on July 28, 1988. UNISON operated this transformer decontamination and reclamation facility from 1988 to 1991 in the Fairfax Industrial District of Kansas City, Kansas. As part of closure, UNISON conducted remediation activities to excavate and landfill approximately 2200 tons of soil and asphalt which was contaminated with polychlorinated biphenyls (PCB). PCB contaminated metal from various equipment and ductwork were removed and landfilled. Contaminated soil from the northwest corner of the building was excavated to groundwater level (about 20 ft below ground surface) and removed. Trichloroethylene (TCE) and PCB contamination from this area of the facility is believed to have occurred from 1983-1986, before UNISON operated the facility and chemical storage and handling facilities were upgraded. A small amount of contaminated soil in the northwest corner could not be excavated safely due to site limitations. The groundwater quality at the site was investigated for chemical contamination after PCB and TCE contaminated soils were found to go to the water table. UNISON contracted with ERM - Rocky Mountain, Inc., to conduct the investigation, which consisted of:

- 1 exploratory boring to determine soil stratigraphy;
- 4 piezometers to give a preliminary indication of groundwater gradient; and
- 6 monitoring wells to determine chemical distribution.

The site is located in the Missouri River floodplain. The topography is dominated by the floodplains and bluffs of the Missouri River. The first bedrock is made mostly of shales and is about 70 ft thick at the site, rendering it relatively impermeable. No faults are found in the area. The soils at the site are alluvial in nature and can be broken down into three regions:

- Upper 40% of vertical profile - silt, clay, and very fine sand;
- Middle 40% - medium sand with interlayers of silt and coarse sand; and
- Lower 20% - coarse sand and gravel.

Findings indicate that TCE has dispersed from the source to the property boundaries, primarily eastward, in the direction of groundwater flow. The measured groundwater gradient is 4.0 feet per mile (0.076 %). Within 120 ft of the source, TCE concentrations diminish to approximately 1% of the highest values. The observed detection of PCB in the groundwater is not conclusive, as the samples were not filtered prior to analysis, and the small concentrations (max. 0.023 mg/L) may be due to PCB sorbed to soil particles in the sample water. Decreased chemical concentrations in the deeper wells indicate little vertical migration of these chemicals. No free phase material was found.

The only credible exposure pathway to subsurface contamination was found to be water ingestion. Fate and transport modeling was used to assess the risk to human health from PCB and TCE in the groundwater. The conservative estimates of the aquifer properties used in the fate and transport modeling have a basis in the data collected and the groundwater models developed at or near the Fairfax District. Because groundwater ingestion was found to be the only credible exposure pathway, the Maximum Contaminant Level (MCL) for PCB (0.0005 mg/L) was used to present a conservative estimate of groundwater contamination. The MCL for TCE (0.005 mg/L) was used to define the TCE groundwater plume.

Even under the many conservative assumptions and scenarios for contaminant transport, groundwater contamination is predicted to not impact human health or the environment. The forward edge of the modeled TCE plume, defined by the 0.005 mg/L line, will not move beyond 150 m (500 ft) from the source before completely dissipating. Both modeling and field data indicate that PCB will not migrate beyond the immediate source area.

The entire Fairfax District is zoned as Heavy Industrial and is likely to remain so in the future. There are no residential areas within the Fairfax District, and no groundwater from the Fairfax District is used for municipal purposes. Despite highly conservative assumptions and scenarios for exposure, no chemical contamination is predicted to reach or otherwise impact a receptor now and into the future. Site remediation as currently completed has substantially eliminated health and environmental risk related to the presence of TCE or PCB.

1.0 INTRODUCTION

This report documents the site investigation and risk assessment of the 3126 Brinkerhoff Road site in Kansas City, Kansas, for the purpose of determining remedial strategy. Objectives include:

- determining levels and distributions of chemicals in the subsurface,
- assessing risk from such chemicals, and
- presenting basis for decisions regarding further remediation.

The topics presented in this document are outlined below. Each Section begins with a short summary of its contents.

Section	Subject
2	Site Description & Facility History
3	Local Geology
4	Local Hydrology
5	Site Groundwater Investigation
6	Chemicals of Concern
7	Contaminant Transport Analysis
8	Current & Future Land Use
9	Risk Characterization
10	Conclusions

References, Tables, Figures, and Appendices are found behind the text in separate sections.

2.0 SITE DESCRIPTION AND FACILITY HISTORY

UNISON Transformer Services operated a transformer decontamination and reclamation facility from 1988 to 1991 in the Fairfax Industrial District of Kansas City, Kansas. As part of closure, approximately 2200 tons of PCB contaminated soil and asphalt from the building and parking lot areas were excavated and landfilled. PCB contaminated metal from various equipment and ductwork were removed and landfilled. Contaminated soil from the northwest corner of the building has been recently excavated to groundwater level and removed. TCE and PCB contamination from this area of the facility is believed to have occurred long before UNISON operated the facility.

This section will outline the history of operations at the facility and provide a synopsis of the remedial activities that have taken place and the present situation.

2.1 Setting

UNISON Transformer Services, Inc. (hereafter referred to as UNISON) has leased the facility at 3126 Brinkerhoff Road since 1988. Located in the Fairfax District of Kansas City, Kansas, the facility is surrounded by industry in all directions. Figure 2-1 indicates the location of the facility in the Fairfax District. To the south, the facility shares the same building structure with a segregated warehouse operated by Central Solutions, Inc. The parking lot and loading area borders Central Solutions' production facilities and offices to the north. Brinkerhoff Road and a Union Pacific Railroad spur border the property to the east and west, respectively. A to-scale map of the facility is shown in Figure 2-2. The property is roughly 32,300 sqft (190'x170') or about 0.75 acres.

2.2 History of Operations

Resulting from chemical handling practices prior to UNISON operation, PCB and TCE contamination at the site is believed to have occurred between 1983 and 1986.

The main business of the facility for the last decade has been decontaminating electrical transformers which used fluids containing polychlorinated biphenyls (PCB) and reclaiming the clean metal parts. Trichloroethylene (TCE) was used as a degreasing solvent to clean the metal parts. Several thousand gallons of TCE were used, recycled, and stored on site. TCE was stored in a large above ground tank just inside the northwest corner of the building and was used in a "triple-sump" degreasing operation in the present "pit" area. The triple-sump involved the transformer parts being washed in three consecutively cleaner solutions of TCE. After flowing through the sump area, TCE was redistilled.

From 1983 to 1986, before UNISON was involved with the operations, reported deficiencies in handling of TCE resulted in spills and leaks. Transformer decontamination started with pilot operations in early 1983, and full-scale operations in June 1984, when an interim permit to handle PCB was granted to EIES (Environmental International Electrical Services, Inc.). In August 1986, EIES overhauled and improved its chemical handling process and storage apparatus. The inside and outside of the facility were "surface" cleaned for PCB, new containment systems were installed, and mass balances on TCE were done regularly. After August 1986, it is unlikely that TCE was introduced to the subsurface.

Distillation units were installed in April 1988 to recover and recycle TCE in the process. UNISON obtained operating rights from EIES in 1988 and completed the commercial re-permitting process in late 1989. The facility operated on a limited basis until 1991, when it was shut down and decommissioned. No known spill or leak incidents were reported during the period of UNISON operation. Site clean-up activities relating to closure have been on-going since 1992.

2.3 Remediation by UNISON

UNISON originally contracted with USPCI for soil removal and disposal and started remediation in December 1992, after the unit was shut down. PCB contaminated concrete from the floor of the building and the underlying nominal 2 feet of soils were excavated and disposed of in a TSCA permitted landfill. The walls and ceiling were sandblasted, and the residual dust was vacuumed from the interior surfaces. Approximately 2200 tons of PCB contaminated soil and asphalt from the parking lot areas were excavated and landfilled. PCB contaminated metal from various equipment and ductwork were removed and landfilled.

During interior soil excavation in early 1993, an area of soil below the floor, approximately 50 ft by 10 ft, was determined to be contaminated by TCE as well as PCB. The area is located along the west wall, in the northwest corner of the building. Soil sampling indicated contamination to 10 ft below the footer of the building. UNISON contracted with Westinghouse Remediation Services, Inc., to excavate the PCB contaminated soil, and treat the soil *ex-situ* to remove TCE to acceptable levels prior to landfilling. To preserve the physical and structural integrity of the west wall of the facility, soil was excavated in "cells", down to a final nominal depth of 13 ft below the building footer. Figure 2-2 indicates the location of the contaminated area as well as the size and placement of the cells.

Upon excavation, the soil was treated by vapor extraction systems in truck roll-off bins to remove the TCE below a level of 5.6 mg/kg in the soil. Upon meeting the criteria, the soil was disposed of in a RCRA/TSCA landfill. Only one soil batch did not meet the TCE standard within the 90 days allowed for temporary storage without a RCRA permit, and it was incinerated prior to landfilling.

The late summer Midwest flood of 1993 temporarily delayed soil removal procedures. At the time, an initial cell was excavated to approximately 6 ft below the footer of the building, and groundwater was observed to a height of 4 ft below the footer. The descent of the groundwater was predicted, based on site observations and at the Missouri River, in order to reinitiate safe excavation of the cells. Figure 2-3 shows the elevation of the groundwater with time, along with a similar plot of the level of the Missouri river.

Cell excavation finally extended to a nominal 13 ft below the footer (approx. 19 ft below typical grade surface). Westinghouse consulted with Alpha-Omega Geotech Inc., who strongly advised that excavation beyond 13 ft. below the footer be avoided and that efforts be taken to stabilize the foundation. Alpha-Omega stated that digging near the groundwater level could cause the immediate failure of the cell walls, undermining the structural integrity of the footer of the facility. The letter from Alpha-Omega is included as Appendix A.

In March 1994, three cells were sampled for both PCB and TCE in accordance with sampling protocol and clean-up criteria. Analyses by EPA and UNISON, revealed that the cells did not meet the PCB criteria (<10 mg/kg - 95% UCL) but did pass the TCE criteria (<60 mg/kg - 95% UCL). Table 2-1 shows the results of that sampling event. UNISON was faced with the immediate decision of attempting further soil removal (due to PCB), which was not advised due to both structural and technical difficulties, or leaving a small amount of contaminated soil, some 20 ft below the original concrete floor. Limited sampling indicated that PCB contamination extended no more than 18 additional inches. UNISON elected to backfill and stabilize the cell openings, in order to avoid the imminent risk of a safety incident or property damage, and leave a small amount of PCB contaminated soil buried in place beneath 19 ft of clean soil fill and a new concrete floor.

2.4 Present Course of Action

Contaminated soil removal has been completed in the pit area to a nominal depth of 13 ft below the building footer. Some complications have developed underneath the northwest corner of the building. The structure needed to be temporarily supported by a cantilevered steel beam during excavation, and the clean fill material eroded to some extent, allowing some settling of the building structure. Actions are underway to secure and correct this situation.

Based on historical and physical evidence, UNISON believes the pit area to be the sole source of TCE related contamination. TCE traveled downward and contaminated the groundwater in a localized area directly beneath the building. Two shallow groundwater wells (PZ-1,-2) were installed in January 1994, to determine if there was a spread of TCE. TCE was found directly north of the building (170 mg/L) and at much lower levels near the southeast corner (0.340 mg/L). These findings prompted a May 1994, groundwater investigation, which is discussed fully in Section 5.0.

This risk assessment is intended to answer questions on the health and environmental impacts that result from: 1) leaving a small quantity of contaminated soil in the subsurface; and 2) the migration of any PCB and TCE in the groundwater.

3.0 LOCAL GEOLOGY

The Brinkerhoff Road site is generally situated in the Central Lowlands Physiographic Province and more specifically in the Missouri River floodplain. The topography is dominated by the floodplains and bluffs of the Missouri River. The first bedrock is the Pleasanton Group, which is made mostly of shales and about 70 ft thick at the site, rendering it relatively impermeable. No faults are found in the area. The soils at the site are alluvial in nature and can be broken down into three regions:

- Upper 40% of vertical profile - silt, clay, and very fine sand;
- Middle 40% - medium sand with interlayers of silt and coarse sand; and
- Lower 20% - coarse sand and gravel.

This section discusses the regional and local physiology, bedrock, and soils.

3.1 Regional Physiography

The Kansas City region is located in the Central Lowlands Physiographic Province and lies on the boundary between two sub-provinces: the Dissected Till Plains Subprovince to the north and the Osage (scarped) Plains Subprovince to the south (Figure 3-1). The boundary between the two sub-provinces is approximately either side of a general east-west line formed by the Kansas River (south of the Brinkerhoff Road site) and the Missouri River, east of its junction with the Kansas River (Jewett, et. al.,1965).

The Dissected Till Plains Subprovince consists of rolling topography formed on the earliest glacial (Kansas and Nebraskan) tills and outwash, as well as later loess (post-glacial aeolian silt) deposits. Sufficient time has elapsed that later post-glacial stream activity has dissected and eroded the surface, and few glacial features remain. Where severe erosion has occurred in the uplands along major rivers, the landscape may be extremely hilly, with exposed bedrock and sharp relief. The Dissected Till Plains generally dominate the topography north of the Kansas River in the immediate site region (Zavesky and Boatwright, 1977).

The Osage Plains Subprovince consists of low relief, gently rolling hills and plains formed by stream erosion of interbedded Pennsylvanian shale and limestone bedrock. The hills are shallow escarpments (cuestas) of resistant limestone while the wide valleys are softer shale. The width of the cuestas and valleys is controlled by the thickness of the individual rock units and the angle of dip. The Osage Plains form the dominant topography south of the Kansas River in the region.

The Missouri River floodplain exhibits alluvial topographical features distinct from those of the Dissected Till Plains and Osage Plains Subprovinces. The Missouri River is in a mature stage of development with a wide floodplain, long meander belts, and related features such as abandoned channels, meander scars, and natural levees. The Missouri has an overwide floodplain and the alluvial deposits are unusually thick compared to expected values based on volumes of water and the size of the existing channel. The size and depth of the alluvium filled valley apparently is due to the large volumes of glacial meltwaters and sediments carried by the pre- and post-glacial ancestral Missouri River (Simms, 1967).

The Missouri River, and the ancestral Kaw River, appear to have occupied nearly the same valley since the latest regional glaciation. The Kaw River valley contains thick, near-surface glacial lodgement tills south of the site. Outwash and tills have been found beneath the Missouri River alluvium indicating the pre-glacial age of the river system. The Kansan glacial advance(s) apparently forced the pre-glacial Missouri system to flow south of the present bluffs and then easterly, before it rejoined the main channel in eastern Jackson County, Missouri. A north-south trending glacial debris filled valley crosses Kansas City and Kansas uplands, just west of the site. In the post-glacial period, the Missouri River reoccupied its former (and present-day) valley (O'Connor and Fowler, 1963; Jewett, et. al., 1965).

3.2 Regional Soils

Soils in the region vary greatly in composition and origin. An east-west line paralleling the Kansas and Missouri River valleys marks the division between the physiographic subprovinces and forms a rough division between the glacially-derived regional soils to the north, and the predominantly residual and colluvial soils to the south (Figure 3-1). Glacial tills and outwash materials are common in the uplands north of the Missouri River and immediately south of the Brinkerhoff Road site (Figure 3-2), whereas residual soils dominate south of the Kansas River. The two rivers generally have thick alluvial deposits resting either on bedrock (Figure 3-3) or on glacial lodgement till or outwash. Loess occurs as thick deposits, veneering the bluffs adjacent to the rivers, but it tends to thin rapidly away from the rivers.

The glacial deposits north of the Kansas River vary from clay lodgement tills, predominantly low and highly plastic clays (CH, CL), to coarse sand-gravel (SP, GP) outwash materials. These deposits originated during the Kansan and possibly the Nebraskan glaciation. Later glaciers did not advance as far south as the Kansas City area. Glacial tills and outwash materials have been encountered in deep borings in portions of the Missouri and the Kansas River valleys, and at sites south of the Kansas River; thus, indicating isolated lobes of the Kansan glaciers probably surged south of the ancestral river valley (Feder,1974; O'Connor,1971).

Alluvium is present in the major river floodplains in the region. The alluvium generally consists of cohesive highly plastic clay and low plastic clay and silt (CL,CH,ML) and very fine-grained granular silty-sand (SM) soils overlying progressively coarser deposits (SP,SW) (Figure 3-3). In most areas, extremely coarse-grained materials (coarse sand and gravel, and boulders deposits designated as SP, GP, GW) are found immediately above bedrock. In smaller streams and rivers, residual low and highly plastic clay (CL, CH) soils often are found between the alluvial or colluvial valley fill material (SP,GP) and the bedrock (KCK,1986; Layne-Western,1984).

Loesses (low plastic clayey silts - ML) and weathered loesses (CL/ML) were formed from wind-blown silts carried from the front of the glaciers, as they melted, or from the sediment choked river valleys. The silts were deposited by the wind in thick layers along the bluffs closest to the rivers and in progressively thinner deposits further away from the sources (Zavesky and Boatwright,1977).

3.3 Regional Bedrock

The near-surface and exposed bedrock units in the site region are part of the lower and middle Pennsylvanian-aged rocks. The regional bedrock pattern is controlled by the Forest City Basin, centered about 50 miles north-northwest of the site (USACE,1979). General regional dips are shallow (<1°) towards the center of the basin and away from the immediate Kansas City area, in a northward direction; thus, progressively younger rocks are exposed towards the center of the basin.

Mississippian and older Ordovician and Cambrian rocks lie below the Pennsylvanian. The Mississippian outcrops well to the south of the near-site region in southwestern Missouri and southeastern Kansas. These are oldest exposed rocks in the region. The Mississippian rocks are chiefly dolomites and limestone with some major chert zones. The Cambro-Ordovician units are predominantly dolomite with some sandstone and occasional shale beds (O'Connor,1971).

The Pennsylvanian rocks in the region are divided into eight geologic Groups. The regional Groups, in order from youngest to the oldest, are the Shawnee, Douglas, Lansing, Pedee, Kansas City, Pleasanton, Marmaton, and the Cherokee. A generalized regional stratigraphic column for the Pennsylvanian is presented in Table 3-1, and a near-region geologic map is presented in Figure 3-4.

Lansing, Douglas, and Kansas City Group rocks dominate the uplands north and south of the River in the area of the site. Portions of the Kansas City, Pleasanton, and Marmaton Group rocks form the bedrock beneath the glacial and thick alluvial deposits in the river valleys. Progressively older Pleasanton, Marmaton, and Cherokee Group rocks are exposed in the uplands in the region to the east and southeast, whereas the progressively younger rocks are exposed to the north and west of the site.

The Cherokee and Marmaton Groups are present in the subsurface throughout the region, but outcrop only well south and east of the area. The Cherokee Group consists of a succession of thick clastic sediments, predominantly sandstone and shales with some interbedded siltstones, underclays and coal beds. The overlying Marmaton contains a series of interbedded shales, sandstones, underclays, coal, and limestones.

The Pleasanton Group outcrops in the southern and eastern sections of the region and forms the bedrock surface under much of the Missouri River floodplain, east of the site. With a few exceptions, the bulk of the Pleasanton strata are clastic materials. Shales and claystones dominate the sequence in the immediate site area, but sandstones are found to the east of Kansas City. Minor limestones occur throughout the sequence. The Pleasanton Group is over 120 ft thick in portions of the region, but thins rapidly north and west of the site. (Figure 3-4).

The Lansing and Kansas City Groups form the bedrock surface on the bluffs and in the uplands, both north and south of the Missouri River, in the immediate site area. The Kansas City Group consists of a series of interbedded shales and limestones forming repetitive cyclic sequences (O'Connor, 1971). Limestones dominate the lower portion, and shales form the bulk of the upper half of the group. Occasional sandstone units are found within or replacing the shales near the top of the sequence. The Kansas City Group varies from 250 to 280 ft thick in the immediate site area (O'Connor, 1971). The Lansing Group has lithologies and sequences similar to the Kansas City Group. The Lansing consists of cyclic sequences of limestones and shales with some coarse sandstones and conglomerates. The Lansing outcrop zone is to the west of the central Kansas City area (Figure 3-4).

Pedee, Douglas, and Shawnee Groups occur above the Lansing. These units form the upland bedrock surface to the west and north of the site. The Shawnee Group consists of cyclic sequences of limestones and shales with some coarse sandstones and conglomerates similar to the Lansing and Kansas City Groups. The Pedee and Douglas are predominantly bedded shales and siltstones with occasional coarse clastics (including channel sands) and some limestones. In the immediate area, the Lansing and Pedee Groups are each some 60 feet thick, the Douglas Group ranges from 110 to 150 feet, and the Shawnee Group is approximately 250 feet thick.

Faults are relatively rare in the Kansas City region but are present in the pre-Pennsylvanian rocks, well below the uppermost bedrock at the site. Complex faulting, associated with down-dropped blocks from pre-Pennsylvanian cavern collapse, is present in the southern part of the Kansas City region, but none have been reported in the immediate site area. Jointing is especially well developed in the numerous limestone units in the stratigraphic sequence and, to a lesser degree, in the shales of the Pleasanton and Kansas City Groups. The majority of joints tend to be near vertical, and strikes vary from northeast to northwest, across the region.

3.4 Site and Near-Site Bedrock

A major channel of the ancestral Missouri River flowed west to east, crossing the Fairfax District south of the present Missouri River channel in a concave crescent shaped trough. A bedrock topographic map is presented in Figure 3-5 (Simms,1967; and Neyer, et. al.,1985).

The bedrock surface is wide with low relief, at a mean elevation of approximately 650 ft msl with steep side walls at the edge of the valley. Imposed on this bedrock surface is a deeper channel representing the ancestral Missouri River, which eroded a deep, moderately steep walled trough in the bedrock surface to elevations on the order of 600 ft msl. The boulder filled portion of this channel is at about 640 ft msl and is roughly 3,000 feet wide (Figure 3-6) (Simms,1987). The center of this channel is approximately 2,000 feet northeast of the site at its nearest approach. The Kansas City Group forms the valley walls of the present Missouri River, and the Pleasanton Group forms most of the wide, low-relief bedrock surface and the ancestral Missouri channel (Simms,1967; and Jewett, et. al.,1965).

The bedrock beneath the site is composed predominantly of Pleasanton Group rocks (Figure 3-4). Determination of bedrock formations and conditions in the site and near-site area are based on bedrock elevations derived by Simms (1967); Neyer, et. al. (1985); boring logs presented in the bid specifications for the City of Kansas City, Kansas (KCK, 1986); regional compilations by the Corps of Engineers (1979), and the Trans-Missouri Tunnel to the east of the Missouri River (Woodward-Clyde, 1990a and b).

Minor limestones and sandstone strata occur throughout the Pleasanton; however, shales and claystones dominate in the immediate site area. Borings penetrating the bedrock in the Fairfax District indicate Pleasanton rocks in the near-site vicinity are gray shales or sandy shales with some pure sandstone interbeds. A boring 300 ft west of the site intersected very hard gray limestone at the bedrock surface at 640 ft msl. A boring 600 ft to the northwest had light blue gray shale and sandstone at 641 ft msl, and a boring 600 ft southwest of the site had gray, carbon bearing shale at 646 ft msl. (Layne Western,1984; KCK,1986; and Fishel,1948)

Based on nearby bedrock elevations and a 95 ft thickness of the Pleasanton Group, about 25 ft of the Group was eroded by the ancestral Missouri River, and 70 ft thus remain beneath the site (Hasan, et.al.,1988; Woodward-Clyde,1990a,b). Logging conducted in North Kansas City, east of the Missouri River, indicate that the Pleasanton Group rocks are relatively impermeable. Groundwater in this strata is carried primarily through joints in the limestone and coarse clastics or along bedding planes between distinct lithologic units (SCS, 1990).

3.5 Site and Near-Site Alluvial Sediments

The Missouri River deposits rather than erodes sediment, and it flows in a valley that is far larger than would be expected for a river this size. Deep, early Pleistocene channels cut into the bedrock were filled by glacial deposits and covered by Missouri River alluvium (Simms,1967; O'Connor,1971; Jewett, et. al.,1965). The deep ancestral Missouri River channel flowed in an easterly direction to a point northeast of the site and then turned south to its junction with the ancestral Kansas (Kaw) River (Simms,1967). This ancestral channel cut across the central portion of the Fairfax District within 600 feet of the site.

The division of Missouri River sediments into three zones applies also to the Fairfax District (KCK,1986):

- An upper cohesive soils zone of silt, clay, and very fine silty sand;
- A middle zone of fine to medium sand; and
- A lower coarse sand and gravel zone.

The near-site area appears to have greater vertical variability and substantially more fine grained sediments at depth than were recognized elsewhere in the Missouri River alluvium (Crabtree and Malone,1984; SCS Engineers,1990).

Poorly graded sediments are most common in the Fairfax District. Approximately 20% of the vertical sediment profile is coarse-grained sands and gravel; 40% is medium-to coarse-grained sands with some fine fraction; and 25% is very fine grained interbedded sands and silts. The remaining 15% consists of surficial deposits of silts, clays and very fine-grained silty sands accompanied by fill (KCK,1986; Layne-Western,1984; Fishel,1948).

The uppermost zone of the natural alluvial profile is obscured by construction, excavation, fill placement activities at the site. It consists of intermixed clays and silts with some very fine-grained silty-sand lenses (ML, CL and SM). The clays are generally low to medium plastic clays, grading into clayey or sandy silts and very fine silty sands. Fill and concrete has been placed over the natural soils to attain present grades. On site, the upper zone varied in thickness from 12 to 18 ft and is reported to vary from 5 to 35 ft elsewhere in the Fairfax District (Fishel,1948; Corps of Engineers,1979; KCK,1986; and Layne-Western,1984). No increase in grain size with depth was noted at Boring S-1 at the site, although such grain size increases are common in the Fairfax District (Jewett, et. al.,1965; Fishel,1948).

The poorly graded middle zone materials at the site contain clay seams, fine sand and gravel lenses, and organic residue (lignite or decayed wood) deposited in the sand. These features are common in the sand deposits throughout the near-site Fairfax District. The medium grained sands at S-1 went from 12 to 58 ft deep. Fine granular material and medium sands comprised more than 50% of the sequence at S-1. This percentage is somewhat higher than others noted in Fairfax District boring logs (Fishel,1948; Corps of Engineers,1979; KCK,1986).

The lower alluvial zone, consisting of coarse sand with fine to coarse gravels, was encountered only at the base of Boring S-1 at a depth of 58 ft. The gravel content of the lower zone typically ranged from ranges from 20 to 50 percent in Fairfax District.

4.0 LOCAL HYDROLOGY

Three basic types of aquifers are present in and around the Kansas City area: upland soil aquifers; shallow and deep bedrock aquifers; and alluvial aquifers. Of these, the alluvial aquifer system of the Missouri and Kansas rivers is the most important, as it has the highest yields, transmissivities, and storativities of any regional aquifers. The groundwater beneath the Brinkerhoff Road facility is part of the Missouri River alluvial aquifer. The conservative estimates of local aquifer properties used in the fate and transport modeling have a basis in the data collected and the groundwater models developed at or near the Fairfax District.

This section discusses the regional and local aquifers and gives estimates of aquifer properties at the Brinkerhoff Road site, based on results from other local studies.

4.1 Regional Hydrogeology

Several diverse groundwater regimes are present at the regional level in the site area. The groundwater domains include generally perched upland soil aquifers, multiple bedrock aquifers, and the alluvial aquifers of the Missouri and Kansas Rivers and their tributaries (O'Connor, 1973; SCS, 1990).

4.1.1 Regional Upland Soil Aquifers

Upland soil aquifers are generally found in the glacial tills and outwash materials in the region north of the Missouri River and in the colluvial and residual upland soils south of the river. These soil aquifers are mostly thin, perched, unconfined aquifers with only occasional confining upper boundaries. Groundwater yield in the upland aquifers is generally low, on the order of a few gallons per minute.

4.1.2 Regional Bedrock Aquifers

Groundwater in the regional bedrock occurs in limited shallow zones and deeper regional aquifers. The uppermost bedrock aquifers are fresh water shallow perched zones and unconfined or semi-confined zones. The deep or regional bedrock aquifers occur in the Pennsylvanian and Mississippian rocks and in multiple confined zones in the Ordovician and Cambrian rocks below the Mississippian. Regional bedrock aquifer characteristics vary considerably. Generalized bedrock aquifer water quality and yields are presented in Table 4-1.

Typically, shallow bedrock aquifers are found in the clastic strata or in the fractured limestones of the Kansas City or overlying Shawnee, Douglas and Lansing Groups, or in the granular sedimentary rocks of the Pleasanton, or carbonate rocks in the lower Pennsylvanian, underlying the Kansas City Group (O'Connor,1971). These perched bedrock aquifers are limited in area and in thickness and generally have lower confining shale layers. Multiple perched aquifers may be present in vertical profiles through the lower (clastic) portions of the lower Douglas Group, in the Pedee Group channel sandstones, and in the lower portion of the Kansas City Group. Recharge to these perched bedrock aquifers is from upland rivers and streams, precipitation infiltration through the overlying soils, or leakage from shallow soil or bedrock aquifers to the lower perched zones. Shallow aquifer groundwater generally is potable, but exploitation for other than domestic or limited agricultural use has been rare in the region because of extremely low recharge rates.

In western Missouri and eastern Kansas the Mississippian and Cambrian-Ordovician deeper aquifers tend to be saline, i.e., > 1000 mg/L total dissolved solids (TDS). Missouri wells in the immediate site region ranged from 16,000 to 41,000 mg/L TDS. Similarly, Missouri wells in the Atokan Series and Cherokee Group (lower Pennsylvanian) in the site region ranged from 15,000 to 31,000 mg/L TDS. In contrast, dissolved solids for shallow wells in the middle Pennsylvanian in Johnson County, southeast of the site, ranged from 119 to nearly 5,100 mg/L TDS.

Near-site aquifer characteristic data for the bedrock aquifers have rarely been published and are not generally available. Regional data have been complied from published and unpublished U.S. Geological Survey (USGS) and Kansas Geological Survey (KGS) files or private sources.

4.1.3 Regional Alluvial Aquifers

The alluvial aquifers are the major groundwater sources in this portion of east-central Kansas and west-central Missouri. The alluvial aquifers are contained in the unconsolidated sand and gravel materials deposits comprising the past and present alluvial floodplains in the region (Figure 3-3). The alluvial aquifers are part of the regional river system composed of the Missouri River and its major tributary, the Kansas River. In the near-site area the lower reaches of Jersey, Nearman, Line, and Eddy Creeks form part of the Missouri River alluvial aquifer but are not exploited as groundwater sources.

The sediments comprising the alluvial aquifer in the Missouri River floodplain in the Kansas City area consist of three generalized layers. The upper portion consists of cohesive and fine grained granular soils, formed primarily as overbank flood deposits. The middle section is made of well graded sand, with occasional interlayering of coarse granular or cohesive materials, reflecting previous river flowpaths. The lower portion of the sequence is a mixture of coarse sand, gravel, and boulders. A general increase in alluvium grain size with depth is well documented in published and unpublished data.

Groundwater is generally unconfined in the medium to coarse grained alluvial aquifers. However, the uppermost unit, consisting of lower permeability very fine-grained or cohesive alluvial materials, may produce semi-confined conditions. Studies of aquifer relations in the floodplain in the near-site region indicate a lag time in dewatering or saturation of the surficial materials compared to the deeper coarse sediments during rising or falling river stages. Regionally, water levels in the alluvium average from 5 to 25 feet below ground level. The saturated thickness typically varies from approximately 70 to 110 feet.

Groundwater flow is controlled by groundwater gradient and hydraulic conductivity (GeoTrans, 1985). Missouri River levels affect local groundwater flow directions (Geotrans, 1985; SCS, 1990). High river levels, generally in the spring, force inland groundwater flow, and low river levels promote groundwater flow riverward. Groundwater flow tends to cross broad river meanders in a general downstream direction.

Alluvium aquifer recharge is from the Missouri River and its tributaries, infiltration from precipitation, and streams or impoundments on the floodplain. Recharge from the bedrock beneath the alluvium is considered to be minimal in the near site region, but bedrock discharge from the bluffs and valley walls is a large source of recharge during falling river stages.

4.1.4 Regional Alluvial Aquifer Characteristics

The alluvial aquifers have high hydraulic conductivities and transmissivities compared to bedrock and upland soil aquifers. Regional alluvial aquifer characteristics vary considerably between the river systems and within each system. Generalized alluvial aquifer characteristics are summarized in Table 4-2.

Pump tests approximately 9 miles downstream at the former Riverfront Landfill (SCS, 1990) indicate a specific yield of 0.08 and transmissivities between 29,400 and 30,800 ft^2/day. Hydraulic conductivities varied from $3.6x10^{-3}$ to $1.6x10^{-1}$ cm/sec. Foreman (1979) measured hydraulic conductivities near Columbia, Missouri, from $1.97x10^{-1}$ to $3.87x10^{-1}$ cm/sec. Crabtree and Malone (1984) indicated that hydraulic conductivity results at the Conservation Chemical Company (CCC) site, approximately 12 miles downriver of the site, correlated well with sediment grain size, as indicated in Table 3-4. They and others (Moraes, 1971, cited by Zatezalo, 1977) found a nearly exponential increase in hydraulic conductivity with the downward coarsening of the alluvial sediment. Geotrans (1985) found that deeper layers have hydraulic conductivity values at least an order of magnitude greater than shallow layers.

Regional data indicate transmissivity values ranging from 6,700 to more than 100,000 ft^2/day. Storage coefficients range from $2.2x10^{-4}$ to 0.27 (unitless). Local groundwater hydraulic gradients are very low, on the order of 0.005 (Crabtree and Malone,1984; Geotrans,1985; Reed and Burnett,1985). Foreman (1979) calculated the ratio of vertical to horizontal conductivity to be between $2.6x10^{-4}$ and $7.2x10^{-4}$.

Geotrans (1985) modeled the alluvial aquifer for the CCC project, downriver from the Brinkerhoff Road site. A two layer baseline model was developed for input into detailed simulation models. The upper aquifer zone (K_1) was modeled as 30 feet thick with a hydraulic conductivity of $1x10^{-2}$ cm/sec. The lower zone (K_2) was considered to be 60 feet thick with an hydraulic conductivity of 1 cm/sec. The model used a 0.4 vertical conductivity to horizontal conductivity ratio (K_V:K_H) and a storage coefficient of 0.2. A model derived for the Fairfax District by Neyer, Tiseo, and Hindo LTD. (Neyer, et. al.,1985) found storativity and infiltration values similar to others (Geotrans,1985; Crabtree and Malone,1984; Foreman,1979; and SCS,1990). The Neyer transmissivity values (> 300,000 gpd/ft) were substantially greater than those derived by Geotrans (1985), SCS (1990), and Foreman (1979) but were in accordance with Crabtree and Malone (1984). The Neyer model components are used as the basis for the aquifer characterization of the site area.

4.2 Site and Near-Site Alluvial Aquifer

The alluvial aquifers of the Missouri and Kansas Rivers are the major groundwater sources in this portion of east-central Kansas and west-central Missouri. They are contained in the unconsolidated sand and gravel deposits comprising the past and present alluvial floodplains in the region. The upper portion of the sequence consists of cohesive and fine-grained granular soils. The middle section consists of poorly graded sands, with occasional interlayering of coarse granular materials. The lower portion of the sequence typically is a mixture of coarse sand and gravel. A general increase in grain size with depth is well documented.

Regionally, water levels in the alluvium will average from 5 to 25 feet below ground level; the average saturated thickness typically varies from approximately 70 to 110 feet. The Missouri River generally dominates local groundwater flow, as described in Section 4.1.

Regional alluvial aquifers have high hydraulic conductivities and transmissivities compared to bedrock aquifers. The site/near-site aquifer characteristics are generally consistent with regional characteristics and are summarized in Table 4-3. Values applicable to the Brinkerhoff Road site are presented in Table 4-4. The data are based on the findings of Neyer, et.al. (1985), Fishel (1948), Geotrans (1985), and Feder (1974).

Bedrock Elevation: Bedrock elevations in the Fairfax District vary considerably due to the presence of a deep ancestral river valley. The bedrock elevation directly beneath the site is estimated to be approximately 645 ft msl, based on the data presented by Neyer et. al. (1985).

Alluvium Thickness: The bedrock elevation dictates the alluvium thickness in the relatively flat Fairfax District (65-145 ft, 100 ft at the site).

Saturated Aquifer Thickness: Depth of saturation is dependent on the alluvium thickness and the Missouri River stage. Average thicknesses in the Fairfax District (43-123 feet) and at the site (80 feet) are based on historical river levels and bedrock elevations. (Katzman and Luce,1991; SCS,1990; Crabtree and Malone,1985)

Transmissivity: Thirty two wells in the Fairfax District have a wide range of transmissivities, from 77,000 to 825,000 gpd/ft, with a median value of approximately 400,000 gpd/ft. Only one well was found less than 200,000 gpd/ft. The transmissivity values for the Fairfax District are much higher than other local Missouri River alluvium (Geotrans,1985; SCS,1990; Foreman,1979).

Coefficient of Storage: An average storage coefficient of 0.15, based on the modeling done by Neyer, et.al. (1985), is assumed to adequately represent the Fairfax District. This value is much greater than other scenarios for the regional alluvial aquifer, in which coefficient values ranged from 1.0×10^{-3} to 2.2×10^{-4}.

Yield: The range in yield for 22 wells in the Fairfax District varied from 80 to 1580 gpm, with an average and median of about 980 gpm. (Fishel,1948) Thus, an estimated yield of 1000 gpm is reasonable for a well at the site.

Specific Capacity: Values for the Fairfax District ranged from 13 to 375 gpm/ft. The average of 60 gpm/ft is a reasonable estimate of specific capacity at the site.

Permeability: Various near-site area values range from 1072 to 7313 gpd/ft^2 (Neyer,et.al.,1985). Values from fine soils (SM, SP-SM) were estimated in the range of 200 to 800 gpd/ft^2, and granular soils (SP) varied from 570 to 4100 gpd/ft^2. A conservative permeability estimate of 5000 gpd/ft^2 was selected for groundwater modeling at the site, based on an expected transmissivity of 400,000 gpd/ft and an aquifer thickness of 80 ft. A reasonable estimate of the permeability for the fine grained soils (SM/SP-SM) is 600 gpd/ft^2. The value for the coarse fraction (SP) was calculated as 6,015 gpd/ft^2.

Hydraulic Conductivity: Few hydraulic conductivity data have been published for the Fairfax District; thus, conductivities are derived from permeability data. Values range from 3.6×10^{-3} to 3.8×10^{-1} cm/sec for the Fairfax District. The average site hydraulic permeability was estimated to be 2.3×10^{-1} cm/sec, based on an average 5000 gpd/ft^2 permeability. Based on site geology, the hydraulic conductivity for the upper portion (ML, SM) of the aquifer is 2.8×10^{-2} cm/sec, and the value the lower portion (SP, GP) is 2.8×10^{-1} cm/sec. These values are very conservative and much higher than those given by Crabtree and Malone (1984). (Table 4-5)

5.0 SITE GROUNDWATER INVESTIGATION

The groundwater quality at the Brinkerhoff Road site was investigated for chemical contamination after PCB and TCE contaminated soils were found to go to the water table. The investigation consisted of:

- 1 exploratory boring to determine soil stratigraphy;
- 4 piezometers to give a preliminary indication of groundwater gradient; and
- 6 monitoring wells to determine chemical distribution.

Findings indicate that TCE has dispersed from the source to the property boundaries, primarily eastward, in the direction of groundwater flow. The measured groundwater gradient is 4.0 feet per mile (0.076 %). Within 120 ft of the source, TCE concentrations diminish to approximately 1% of the highest values. TCE is being transformed to 1,2-DCE, which was also detected in several samples, by reductive dehalogenation. The observed detection of PCB in the groundwater is not conclusive, as the samples were not filtered prior to analysis, and the small concentrations (max. 0.023 mg/L) may be due to soil particles with sorbed PCB in the sample water. Decreased chemical concentrations in the deeper wells indicate little vertical migration of these analytes. No free phase chemical was found.

This section details the procedures of the site groundwater investigation and presents the results of groundwater analyses.

5.1 Site Investigation

Hydrogeologic field investigations were conducted by ERM - Rocky Mountain, Inc., in April and May of 1994. Field activities included mobilization, site layout, drilling, installation and sampling of groundwater monitoring wells, and surveying of the property. Existing data were reviewed, and an abbreviated Health and Safety Plan (HSP) was prepared prior to field activity. The HSP presented a site description, emergency information and procedures, and specific and general field safety procedures. A copy of this plan was kept at the site throughout the field activities. ERM and subcontractor personnel were required to read and sign the HSP prior to the field activities.

The first phase of field work was drilling one 60 ft deep stratigraphic boring (S-1) to determine soil stratigraphy and installing two additional piezometers (PZ-3,-4) to determine local groundwater head gradient. Six monitoring wells were installed in the second phase to determine the distribution of chemicals in the subsurface. Groundwater from the six wells and four piezometers were sampled and analyzed. Also, all boring and well locations and elevations were surveyed, and these data were incorporated into the site maps. Well and piezometer locations are indicated in Figure 2-2.

5.1.1 Borings, Monitoring Well and Piezometer Installation

The initial phase of field activities included the drilling of one stratigraphic boring and the installation of two piezometers.

A 60-foot deep stratigraphic boring (S-1) was drilled near the west-central edge of the site. This boring was initially advanced with a 3-7/8 inch fishtail bit using a bentonite-water slurry. The boring was drilled with a Gardner-Denver D-50 truck mounted drill rig. Upon reaching a depth of 30 ft the boring was reamed and a 4 inch ID steel casing and bentonite seal were installed to seal the upper portion of the boring from the lower portion. Drilling resumed through the 30-foot steel casing.

Split spoon soil samples were obtained using Standard Penetration Test (SPT) methods. Samples were taken on 24-inch centers to 22 ft, and on 18-inch centers below that depth. They were then preserved in glass jars and labeled. The boring was logged using the Unified Soil Classification (USC) System descriptions of the samples, and observations of drill rig advancement, down-pressure, and drilling characteristics. Boring logs are presented in Appendix B.

A small portion of each sample was temporarily placed in a plastic bag and labeled. A photo-ionization device (PID) was used to measure contaminant levels from each split spoon. The PID was used on the head space in each of the plastic bag samples and on the borehole and breathing space zones for Health and Safety monitoring.

Two (2) borings were drilled to depths of 30 feet for the installation of piezometers. One boring was in the building at the southwest corner of the site and the second in the northeast corner of the site, along the fence line. The borings were drilled with a CME-55 mounted on a Ford tractor using 4-¾ inch ID hollow stem augers. A Teflon plug was used to prevent sands from entering the hollow stem augers during the drilling process. These borings were advanced to approximately 10 feet below the unconfined groundwater surface.

Piezometers (PZ-3 and PZ-4) were installed in each of these two borings. Since the soil materials were considered unstable, the piezometers were constructed through the inside of the hollow stem augers. The piezometers were made of 2 inch ID, Schedule 40, threaded and flush-jointed PVC pipe. The lower 10 feet of each piezometer were screened with 0.01 inch factory-machined slots. A flat cup or well point was attached to the bottom of each piezometer screen. Filter material, consisting of a fine to medium sand, was placed around the well screen using a tremie. The filter pack was installed to approximately 2 ft above the top of the screened interval, and approximately 2 ft of bentonitic clay seal was placed above the filter. Hydrated bentonite chips or pellets were used above the water table. The riser pipe was backfilled with a cement-bentonite slurry to grade. A flush-mounted protective steel locking surface casing was placed around the piezometer riser pipe and a shallow concrete pad was constructed at the surface around the surface casing. Piezometer construction diagrams are presented in Appendix B.

The piezometers were developed by pumping between ten and twenty well volumes of groundwater from each piezometer. Initially, a 2 inch diameter stainless steel bailer was used for purging. Later, a Redi-flow electric pump (1.5 - 2 gpm) was used. All development water was stored in 55-gallon drums, sealed, and labeled. Groundwater levels were measured from the four piezometers to determine the placement of subsequent borings and wells.

Six additional borings were drilled at selected locations within the boundaries of the site. The borings were advanced with a truck-mounted Gardner-Denver D-50 truck mounted drill rig, using hollow stem augers (4 ¾ inch ID) to depths of approximately 30 to 45 ft below the grade. To compensate for hydrostatic pressures forcing flowing (running) sands into the hollow-stem augers, the borings were over-drilled and Teflon knock-out plugs were used. Monitoring wells were installed at all six boring locations. Well installation procedures and materials used were the same as those used for piezometer installation.

Wells MW-14A, MW-13A and MW-13B were finished with flush mounted metal protective surface caps and concrete protective pads. Wells MW-11A, 12A and 12B were placed inside the building in areas that are expected to receive fill material at a later date. These wells were grouted to the present ground surface, and riser pipe was added to extend the wells above ground level. When fill material has been added the riser pipe will be grouted to the new floor surface, and flush mounted protective caps will be installed. Well and piezometer data are summarized in Table 5-1.

Health and safety monitoring during drilling was done through the use of PID monitoring in the breathing zone, at the well head, on samples, and in the head space of the jarred samples. Field work was accomplished using OSHA Level D personal protective equipment (PPE) with the exception of the work at the MW-13 cluster. High PID readings necessitated upgrading to Level C PPE during drilling and well installation at this cluster.

Well materials were decontaminated by steam cleaning and wrapped in plastic sleeves prior to mobilization to the site. Personnel used disposable plastic gloves during the handling of the well materials. The sampling equipment was decontaminated between samples by scrubbing with an Alconox-distilled water solution and rinsing with distilled water. Decontamination between borings of the hollow-stem augers and sampling equipment was done with high-pressure steam. Drill cuttings and sample materials were collected and placed in disposal units on site for eventual disposal at an hazardous waste landfill. PPE (gloves, Tyvek suits, etc.) were placed in hazardous waste disposal containers in the facility laboratory for later disposal.

5.1.2 Groundwater Level Measurements

Ground water depths were measured at all piezometers and monitoring wells with an electronic water level meter. The high point on each PVC riser pipe was used as a standard reference, as they were surveyed to the nearest 0.01 ft (U.S. Coast and Geodetic Survey datum). Groundwater elevations are listed in Table 5-2.

5.1.3 Groundwater Sampling Procedures

A single round of groundwater samples was obtained from the wells and piezometers to define the extent of contamination by PCB, TCE, and other volatile organic compounds. Pace Laboratories, Inc., of Overland Park, Kansas, was hired to do the analyses.

Each well and piezometer was purged a minimum of 3 well volumes prior to sampling. Well volumes were calculated based on wetted well surface, depth and diameter for each well. A Rediflow electric pump was used to pump purge water at a rate of 0.5 - 2 gpm to either 55-gallon drums or 5-gallon buckets which were emptied into drums. The hoses and pump were decontaminated before use at each well. The purging continued until the physical measurements of the purge water (conductivity, pH and temperature) had stabilized within a 10 percent range. Personnel wore latex surgical gloves when handling the pump and purging equipment.

A stainless steel, two-inch diameter bailer was used to sample each well. The first bailer of water obtained from any given well was used to fill the volatile organic compound vials. No air bubbles were permitted in these vials. Subsequent volumes of water were used to fill the vials for PCB analyses. Appropriate preservatives had been placed in the sample containers by the laboratory prior to shipment to the site.

The stainless steel bailer was decontaminated between each well using alconox-distilled water solution and distilled water rinses. The bailer rope and surgical gloves were discarded between sample points. The decontamination water was collected and disposed of with other decontamination water. PPE and bailer rope were placed in hazardous waste disposal containers in the facility laboratory for later disposal.

One set of laboratory supplied trip blanks and one set of duplicate (blind) samples were analyzed as part of the overall project quality assurance/quality control program. The sample containers were sealed, labeled, and enclosed in self-sealing (zip-lock) polyethylene bags. Sample label designations were based on the well or piezometer number with the exception of the field duplicates (MW-13B) which were given an arbitrary number (MW-15A) in sequence with the total number of wells.

The bagged sample vials were shipped in coolers, packed with vermiculite, and topped with frozen packets of "blue ice". The coolers were sealed, labeled, and transported to Pace Laboratories by ERM personnel. Each cooler was accompanied by a chain-of-custody form signed by the sampler, transporter, and laboratory personnel.

5.2 Site/Near-Site Groundwater Gradient and Flow

Groundwater elevations varied from 727.50 to 727.64 ft msl across the site. The measured groundwater gradient is 4.0 feet per mile (0.076 %) to the east (Figure 5-1). This compares favorably with gradients presented in the literature of four to five feet per mile (SCS 1990; Fishel, 1948).

Groundwater flow data for the Fairfax District are not available. Groundwater velocity was calculated using the Wenzel formula (Fishel, 1948) for fine silty materials and sands:

$$v = [(\text{permeability in g/d/ft}^2)(\text{gradient in ft/mi})] \div [(395)(\text{porosity in \%})].$$

Velocities ranged from 0.2 ft/day for silts to 2.0 ft/day for sands, based upon conservative estimates of the permeability for the deeper, coarser part of the aquifer. Average velocities for the Fairfax District based on maximum and minimum values for permeability and gradient were calculated to be $4.2x10^{-3}$ ft/day for silty units and 3.70 ft/day for sands and gravels. These compare well to velocities of $5x10^{-2}$ ft/day for silts and 1.3 ft/day for sands for the Fairfax District. (Fishel,1948)

Groundwater velocity will vary with depth because of changes in grain size and hydraulic conductivity. It will be greater in the sand than in the interbedded silts and clays. The velocity, direction, and gradient of the groundwater will also vary with the time of the year, as the Missouri River level changes. (GeoTrans,1985; Foreman,1979; SCS,1990; Katzman and Luce,1991). The position of recharge and discharge points will control local gradients, as mounding will occur where runoff is directed to drainage swales and man-made conduits. These factors may exert a temporary influence on gradients in the immediate vicinity of the site.

A generalized flow map has been constructed, based on flow directions constructed perpendicular to the potentiometric contours for the Fairfax District (Figure 5-1). The potentiometric contour positions are based on patterns observed during year-long monitoring of Missouri River/alluvial aquifer interaction at the Riverfront Landfill site, ten miles downriver from the Brinkerhoff Road facility (SCS, 1990; Katzman and Luce, 1991). Based on the Riverfront example, groundwater flow across the site is generally to the northeast, changing to a more easterly direction with increasing river underflow. This correlates well with the barely perceptible easterly gradient measured at the site. Potentiometric surface and groundwater flow across the site are presented in Figure 5-2.

5.3 Analytical Results

The ten on-site wells and piezometers were sampled and analyzed for volatile organic compounds (VOCs) (method 8240) and PCB compounds (method 8080/608) by Pace Laboratories.

Only two VOCs, trichloroethylene (TCE) and 1,2- dichloroethylene (1,2-DCE), and two PCBs, Aroclor 1242 and Aroclor 1260, were detected in some of the groundwater samples. Method detection limits varied from sample to sample, depending on the compound concentrations. The analytical results and quality control data are presented in Appendix C. Table 5-3 summarizes the results by sampling point.

TCE was detected at levels ranging from 0.088 mg/L to 670 mg/L, and 1,2-DCE ranged from non-detect to 120 mg/L. All ten samples exceeded the Maximum Contaminant Level (MCL) for TCE 0.005 mg/L. Six of the ten samples exceeded the MCL for 1,2-DCE of 0.1 mg/L, and three samples were tested at method detection limits (0.25 to 20 mg/L) in excess of the MCL. Aroclor 1260 ranged from non-detect to 0.0230 mg/L, and one sample had measurable Aroclor 1242 at 0.0016 mg/L. The four samples with detectable PCB exceeded the MCL of 0.0005 mg/L.

No free phase chemical was found.

5.4 Groundwater Quality

Figure 5-3 is a logarithmic contour plot of TCE distribution. The highest TCE concentrations and the center of the plume are found near the northwest corner of the building, and the lowest TCE levels are located at the northeast corner of the property. The axis of the plume stretches in a general east-west direction, with TCE concentrations rapidly attenuating to approximately 1% of the highest values within 120 feet of the source. TCE was detected in both of the deep wells (MW-12B and MW-13B) at lower concentrations than the shallow wells (Table 5-3). The shape and extent of the TCE plume (Figures 5-3) is consistent with the groundwater gradient (Figure 5-2).

1,2-DCE was detected in five of the eight shallow wells and two of the deeper wells. 1,2-DCE was non-detect in the remaining wells, but the method detection limits were relatively high in at least two of the analyses (in excess of 2.5 and 20 mg/L). The method detection limit for the sample at MW-13B was 20 mg/L, and 1,2-DCE was detected at 24 mg/L in the blind duplicate sample from MW-13B (labeled MW-15A, Appendix C).

PCB was detected in the groundwater at two shallow wells (MW-13A and MW-11A) and one deep well (MW-13B). The highest PCB concentration (0.023 mg/L) was found at well MW-13A, outside the northwest corner of the building. Groundwater samples were not filtered prior to PCB analysis. Therefore, the low PCB concentrations may come from PCB which was sorbed on particulates in the water and not from dissolved aqueous phase.

Ratios of 1,2-DCE to TCE vary from a low of 0.07 to a high of 0.9 DCE/TCE. The ratios increase in a downgradient direction (compare Figure 5-2 with 5-4). This increase is expected, as DCE is formed by the degradation of TCE. The DCE concentration is expected to increase with time as the TCE concentration decreases. Decreased chemical concentrations in the deeper wells indicate little vertical migration of these analytes.

6.0 CHEMICALS OF CONCERN

The two chemicals of concern are polychlorinated biphenyls (PCB) and trichloroethylene (TCE). The only other chemical detected is 1,2-dichloroethylene (1,2-DCE), which is believed to be solely a "daughter" product from the reductive dehalogenation process of TCE. No historical data exists for the presence of 1,2-DCE at the site, and the dehalogenation process is well known. Figure 6-1 shows a schematic of the dehalogenation process.

This section discusses the chemical and physical properties of PCB and TCE.

6.1 PCB

Polychlorinated biphenyls are complex mixtures of chemicals composed of multi-ringed, chlorinated compounds. They are highly inert, persistent in the environment, and characterized by very low vapor pressures, low water solubilities, and high partition coefficients. They were used in the electrical transformer industry as insulator fluid additives for their excellent heat transport properties.

Aroclor 1260 (CAS# 11096-82-5) accounted for 87% of the PCB handled at the facility and is the chemical used for contaminant transport modeling. Aroclor 1260 is a mixture of biphenyls with varying degrees of chlorination (4 to 7 chlorine atoms per molecule) and is one of the heaviest, most strongly sorbed, and most environmentally persistent PCB. The properties of Aroclor 1260 as used for modeling are shown in Table 6-1.

PCB is labeled as a Class B2 carcinogen (probable human carcinogen) by the IRIS database (USEPA, 1994). This rating is based on studies which found direct evidence for formation of hepatocellular carcinomas in three strains of rats and two strains of mice. There is inadequate yet suggestive evidence of excess risk of liver cancer in humans by ingestion and inhalation or by dermal contact.

Although there is some evidence to suggest that PCB can degrade in the subsurface, it is assumed from a point of conservancy in the modeling that PCB does not degrade. Due to the presence of TCE in the contaminated soil, it is also assumed that the solubility is 1000 times greater and sorption properties are 1000 times less than they would be otherwise. Further modeling assumptions are noted in Section 7.3, and modeling results are discussed in Section 7.4.

PCB has been found in groundwater only in areas where TCE is at or near its solubility limits (e.g. MW-13A). PCB cannot be transported in the groundwater unless TCE is present at concentrations near the solubility limit.

6.2 TCE

TCE (CAS# 79-01-6) is a common solvent with a clear, colorless, watery appearance and a chloroform-like odor. It is highly volatile and denser than water. It can biodegrade under reducing conditions, but it usually cannot be oxidized. Table 6-2 contains the physical/chemical properties as they were used for fate and transport modeling.

The carcinogenicity rating for TCE has been withdrawn by EPA, and a non-carcinogenic rating is pending. (USEPA,1994) It was formerly rated as a Class B2 carcinogen (probable human carcinogen), based on significant increases of liver tumors and malignant lymphomas in mice. There is inadequate evidence of human carcinogenicity. The Maximum Contaminant Level (MCL) for TCE (0.005 mg/L) is used for all risk/exposure scenarios.

The rate of biodegradation was used as a variable for calibrating the model to site conditions. Matching site conditions, the estimated biodegradation rate is less than 100 times that reported in the literature; therefore, the value is conservative.

7.0 CONTAMINANT TRANSPORT ANALYSIS

In order to assess the risk to human health and the environment from subsurface chemicals at the site, fate and transport modeling was used to help describe the chemical transport phenomenon. The most critical exposure pathway to subsurface contamination was found to be water ingestion. Modeling results indicate the TCE groundwater contamination will move eastward, towards industrial wells located about 0.8 miles from the site.

Even under the many conservative assumptions and supposed conditions for contaminant transport, groundwater contamination is shown to not impact human health or the environment. The forward edge of the modeled TCE plume, defined by the 0.005 mg/L line, will not move beyond 150 m (500 ft) from the source before completely dissipating. Both modeling and field data indicate that PCB will not migrate beyond the immediate source area.

The section discusses and evaluates: 1) the different pathways of exposure; 2) the conceptual and computer models used to evaluate chemical fate and transport; 3) the results of the computer modeling; 4) the elements of conservatism inherent in the modeling; and 5) the impact of the 1993 summer floods on the site groundwater quality.

7.1 Exposure Pathway Analysis

Exposure to the chemicals remaining in the subsurface may take place only through excavation of the soil or through pumping of the groundwater. Several exposure routes are discussed:

- Inhalation
- Water Ingestion
- Soil Ingestion
- Dermal Contact
- Particulate Inhalation

Application of specific site conditions to these exposure routes is discussed in Section 9.0 (Risk Characterization).

7.1.1 Inhalation of Vapors and Particulates

The contamination from TCE and PCB at the site is limited to strata far beneath the surface. PCB contaminated soil left unexcavated lies roughly 20 feet below grade. The TCE resides mostly in the groundwater and saturated strata. The source of contamination has been excavated from the pit area, leaving no surface or near surface source for exposure.

The only receptor by this pathway might be a worker who is digging or drilling on the property into the affected media. At that depth TCE could be released, but only in limited quantities that could cause an odor nuisance or minor health risk. While not volatile, PCBs can adhere to particles which may be inhaled.

Other potential risks to site personnel from inhalation are emissions from remediation technologies such as groundwater air stripping or soil vapor extraction. Off-gases from such technologies are treated to the proper health based level, based on the chemical. Aside from remediation activities, no vapors should escape as long as the subsurface remains undisturbed to the water table. Left undisturbed, there is no pathway for vapors from 20 ft below grade to the surface. The exposure potential is further limited by the ground covering at the site: concrete flooring in the building and asphalt paving in the parking lot and loading areas.

7.1.2 Soil Ingestion

As previously described, residual chemical present in the soil lies about 20 ft below the surface, underneath the building. The receptor would be a person who would ingest the contaminated soil. The building would need to be demolished, and the entire area would need to be excavated in order for the soil to be accessible. Typical building construction in the Fairfax District extends less than 10 feet down. The current building footer only extends about 6 feet below the surface. Thus, excavation to that depth in the immediate vicinity of the building is unlikely.

This scenario is improbable, and any exposure from soil ingestion is based on an almost impossible exposure route.

7.1.3 Dermal Contact

Similar to inhalation exposure, dermal contact with affected media can occur only in instances of drilling, excavation, or a similar action. Skin irritation can result from exposure to PCB and TCE contaminated soil. No other risks are involved with dermal exposure, and protective clothing (e.g., work gloves) is adequate prevention. MSDS sheets for PCB fluids and TCE are included as Appendix D.

7.1.4 Water Ingestion

While soil ingestion is unlikely, water contamination could migrate far offsite to potential receptors - in this case, drinkers of municipal or private well water. No drinking water wells are located in the Fairfax District; however, there are several water wells in the area of the General Motors plant, approximately 0.8 miles away (Figure 2-1).

PCB is very persistent in the soil and almost insoluble in water. TCE has a moderate solubility (Table 6-2) and is believed to have been transported in low concentrations off site. Contaminant fate and transport modeling is a very helpful technique for predicting the level and extent of contamination beyond the limited site data. This scenario and the risk to water drinking receptors are discussed Sections 7.2 and 9.0.

7.2 Groundwater Pathway Analysis

PCB is transported in the subsurface only under unusual conditions, as they sorb strongly onto the soil particles (see Section 6.0 for more detail). PCB will move only when:

- TCE is present in high concentrations, and PCB is coeluted with migrating TCE, or
- Small grained soil particles with sorbed PCB are transported.

Thus, the transport of PCB and TCE are inextricably linked. This solvency mechanism is what transported PCB to such a depth from the inside of the building.

Risk due to TCE and PCB migration is determined by using fate and transport analysis and examining the migration pathway of the groundwater as it relates to the Missouri River and groundwater wells. A piezometric study was conducted of the site groundwater. The gradient over the site was found to be very shallow (0.076 %) to the east. This head difference (0.1 ft) is within the overall measurement error. The fact that it extends toward the east, as indicated in Figure 5-2, correlates well with the groundwater flow for the Fairfax District, shown in Figure 5-1. The flowlines indicated in Figure 5-1 are constructed from perpendiculars to the piezometric contours for the area.

No drinking water wells are located within the flowfield. The nearest wells, used only for industrial purposes, are located at the General Motors plant. These wells are about 0.8 miles away from the site and are closely aligned with the groundwater flowlines from the site area. These wells are a possible receptor for any chemicals that may travel that far, but the water is not used for drinking.

While the wells are the most likely receptors based on data obtained from the site investigation and the Fairfax District, the possibility of contamination to the Missouri River must also be considered. The most direct path to the Missouri River is due north from the site (0.7 miles); however, that path goes against groundwater flowlines. The more realistic path to the river would be through the well fields at the General Motors plant; therefore, the wells at General Motors are considered the most likely places for reception.

7.3 Fate and Transport Analysis

Fate and transport of PCB and TCE at the site were estimated using the EPA approved computer package RISKPRO. RISKPRO can be used to predict the environmental risks and effects due to the exposure from pollutants in the air, soil, and water. Specifically, the groundwater transport was modeled using the compartment model AT123D (Analytical Transient 1-2-3 Dimensional Model). AT123D predicts the lateral and vertical spread of a chemical plume through the groundwater (saturated zone) and estimates the chemical concentration within the groundwater at positions on a user-specified three-dimensional grid. It can handle constant as well as time-varying chemical releases to the groundwater from a single point, area, line or volume source. Chemical releases may be of an instantaneous, continuous, or finite duration. There is no mechanism in the model to account for free-phase ganglia or residual source material. A detailed technical explanation of AT123D is given by Yeh (1981).

In order to be manageable for mathematical modeling, the site hydrogeologic condition was simplified to simulate contaminant migration. The source was assumed to be the "footprint" of the pit area on the top of the aquifer. The aquifer was assumed to be infinitely wide and 80 ft deep. Only single component contamination can be modeled by AT123D; therefore, the approach was to calibrate the model using site data for TCE and then apply that model several years into the future for both PCB and TCE.

The chemicals were modeled as if they were released continuously from 1983 until the present, the assumption being that the pit was acting as the only source of contamination and as of August 1994, the source will have been removed. Any assumptions were made to be conservative using best engineering judgment and experience.

Pertinent physical/chemical data for TCE and PCB are presented in Section 6.0. Properties for TCE were inserted directly into the model. As is shown by the high adsorbance and low solubility of PCB, it greatly prefers the solid phase and resists aqueous solution. In order to model contaminant transport of PCB in the groundwater, it was assumed that the TCE in the groundwater caused a co-solvency effect. At high concentrations of TCE, PCB could perhaps enter the groundwater at concentrations higher than normal and be transported. To be conservative, no degradation of PCB was assumed to occur.

7.4 Model Results

Results from AT123D showing chemical distribution are superimposed on either a site map or a local map of the Fairfax District to relate the plume concentrations and distances traveled with time. Plots of actual model outputs are available as Appendix E.

7.4.1 TCE Model Results

Figure 7-1 shows the current TCE groundwater plume, modeled as closely to site conditions as possible. Year 11 indicates the current year, 1994, and all yearly references are to made to 1983 being Year 1. The plume is shown to extend beyond the facility fenceline, elongating to the east with the groundwater flow. The scale is logarithmic; contours are plotted on orders of magnitude. At the 0.005 mg/L level the plume extends about 115 meters to the east. The bulk of the chemical is in a small area less than 50 meters from the source. Figure 7-2 shows the same plume as it relates to the local area of the Fairfax District.

As shown in Figure 7-2, TCE contamination, at the 0.005 mg/L level, extends about 35 meters west from the source. The source is located very near the west fenceline, and no wells were located west of the source. Because the groundwater flow is in the easterly direction, and advection/dispersion is the main transport mechanism, the model shows most contamination travels to the east. Figure 5-3 may be used for comparison of model results to actual field data.

The phenomenon of chemical movement to the east is more clearly pronounced in Figure 7-3 (Year 26, 2009), which shows the center of the plume will move approximately 100 meters downgradient from the source area in the next 15 years. This prediction rests on primarily on the assumption that the source of contamination was removed. Due to the degradation of TCE, as already indicated at the site, the 0.005 mg/L level has migrated only to about 150 meters from the source, and the highest concentration at the center is about 0.01 mg/L. By Year 31 (Figure 7-4) the center of the plume has moved 125 meters east of the source, with the highest concentration at about 0.005 mg/L. With time, the plume continues to travel with the groundwater in the easterly direction, though only at residual concentrations (below 0.005 mg/L).

Model results show that by the present time (Year 11), TCE has reached the bottom of the aquifer, largely due to advective/dispersive forces. Appendix E contains the model results, plotted as length along the plume axis (X) against depth (Z). As was found in the site investigation, concentrations decrease with depth near the source (MW-12A,B and MW-13A,B, Table 5-3). Further from the source, the concentration profile flattens vertically, indicating TCE becomes evenly distributed over the depth of the aquifer. By Year 26, TCE concentrations at depth are predicted to be less than the 0.005 mg/L, with higher concentrations at the surface.

7.4.2 PCB Model Results

Model results indicate that PCB will remain highly localized. Figure 7-5 shows the model results for Year 11 (present) plotted onto a map of the site. Modeled PCB concentrations near the source are much higher than the field data is order to simulate PCB transport. Wells further away from the source indicate no presence of PCB, yet the model predicts concentrations to be on the order of part per billion. By Year 26 (Figure 7-6), PCB is predicted to have dissipated only slightly, with the plume gradually moving to the east. Figure 7-7 (Year 71) shows that PCB concentrations remain high (ppm), and the plume retains its size and position; it moves and dissipates very slowly. The plume is much more symmetrical from east to west than it was for TCE, though the plume center is about 35 to 40 meters east of the source. The model results are essentially an extreme worst case scenario, since it was assumed that TCE was present in high quantities everywhere to facilitate PCB transport.

In assuming that the sorption for PCB is lower and the solubility is higher by several orders of magnitude, it was also assumed that TCE would be present in high concentrations to facilitate transport. This is perhaps the case in and around the source, but not at distances greater than 15 m from the source. Also, to show any transport, PCB loadings had to be raised to very high levels. PCB mass loadings to the aquifer were raised to 1% that of TCE (Table 7-1). The effect of this high loading is found at the center of the modeled plumes, in the PCB concentrations which are several orders of magnitude higher than observed in the field.

Even with the conservative modeling assumptions, PCB is not predicted to reach the bottom of the aquifer. The plume is shown to descend about halfway into the aquifer before dissipating below calculable levels.

7.5 Modeling Conservatism

Several assumptions were made to produce models of TCE and PCB contamination in the groundwater. Whenever possible, conservative values were used to provide assurance of credibility.

For modeling TCE, physical properties from the literature were used whenever possible. Model input parameters are indicated in Table 7-1. Input parameter values are displayed as either given values (from a text or other source), variables, or assumptions. In all cases, efforts were made to use conservative estimates for input variables. The main parameters which were varied to simulate site conditions were contaminant loading (rate of chemical introduction to the subsurface) and average hydraulic conductivity. Less important (fine tuning) variables were longitudinal, transverse, and vertical dispersivities, and the chemical degradation rate.

Several modeling parameters and situations were assumed so as to present conservative estimates of contaminant transport. The hydraulic conductivity was assumed to be 1×10^{-2} cm/sec for the entire depth of the aquifer, but it is probably considerably less in the silty clay strata where most of the contamination resides. The effective porosity, i.e. the connected pore space, was assumed to be 28%, though it is probably much lower in the fine-grained top strata. Soil organic content, the chief sorptive material in soils, was assumed to be 0.1%, even though evidence suggests it is much higher (boring logs, Appendix B).

To simulate site conditions, the release rate for TCE was assumed to be 0.015 kg/hr for 137 months (1983 to 1994). This translates to 1480 kg, or 2100 L, of TCE released over 11 years. In reality, nearly all the TCE was released during a three year period (1983-1986) early in the history of the transformer reclamation facility (Section 2.0). The biodegradation rate for TCE and the longitudinal, transverse, and vertical dispersivities were used to estimate the size and extent of the groundwater plume as indicated by the field investigation.

PCB release was assumed to be 1/100 that of TCE. This is undoubtedly a conservative figure, as the PCB concentration in the original transformer fluids was less than 1% (Appendix D). The actual ratio of PCB to TCE was probably on the order of part per million. The coefficient of retardation (K_D) for PCB was assumed to be 500 times smaller than the average literature value, on the basis that high concentrations of TCE produce a co-solvency effect and transport the PCB. This may be the case at or very near the source area (the "pit"), but is not the case anywhere else. Modeled concentrations of PCB are over 2 orders of magnitude higher than field data suggest, indicating a highly conservative scenario. It is likely that PCB is not in the groundwater at all, because the low concentrations found by GCMS were determined for unfiltered samples, which may have had PCB sorbed on suspended particulates.

7.6 Flood Analysis

In response to the 1993 Midwest floods and the situation described in Section 2.0, an analysis was made to determine the possible effects the flood might have had on contaminant transport. At the time, the source material was still in place, and excavation at the pit had just begun. Equilibrium relationships were used to predict the maximum amount of chemical that could have been transported into the aquifer from the source material. Based on the equations and calculations shown in Appendix F, approximately 5 kg of TCE and 1 g of PCB could have moved from the sorbed phase to the water soluble phase and been transported into the aquifer. This represents only a small fraction (0.3%) of the total chemical introduced to the groundwater and is insignificant when considering the overall contamination scenario.

8.0 CURRENT AND FUTURE LAND USE

Current land use at and near the Brinkerhoff Road site is zoned Heavy Industrial only. The entire Fairfax District is zoned as Heavy Industrial and is likely to remain so in the future. The Fairfax District encompasses the entire groundwater flow path from the site. There are no residential areas within the Fairfax District, and no groundwater from the Fairfax District is used for municipal purposes.

9.0 RISK CHARACTERIZATION

EPA guidance states that remediation to a 10^{-4} or 10^{-6} risk level is not necessary for groundwater that is not a potential source of drinking water. Nevertheless, because groundwater ingestion was found to be the only credible exposure pathway, the MCL for PCB (0.0005 mg/L), which falls between those risk levels, was used to present a conservative estimate of groundwater contamination. The MCL for TCE (0.005 mg/L) was used to define the TCE groundwater plume.

Despite highly conservative assumptions and scenarios for exposure, no chemical contamination was found to reach a receptor or otherwise impact anyone or anything now and into the future. TCE is predicted to naturally attenuate well before reaching any possible receptor, and PCB modeling predicts the chemical will not leave the immediate site area, even under the highly conservative transport scenario. No further remediation is necessary to reduce risk to human health or the environment.

This section assesses the potential risk to receptors by: selecting the appropriate risk levels and corresponding chemical concentrations; and considering all the information assembled in this report to form a basis for risk characterization.

9.1 <u>Selection of Maximum Allowable Exposure Concentrations</u>

In the proposed RCRA, Part 264, Subpart S regulation (USEPA, 1990B), EPA suggested a lifetime, on-site, residential exposure scenario for the purpose of calculating an action level below which: 1) no further action is necessary, and 2) the contamination level is considered safe. In deriving action levels for hazardous constituents in groundwater, a daily water intake rate of 2 liters per day over a 70 year lifetime exposure period is assumed.

Depending upon site-specific or remedy specific factors, the acceptable risk level may range from 10^{-4} to 10^{-6} for Class A and B carcinogens. PCB is considered a Class B carcinogen which is accumulated in the body over a lifetime to simulate a conservative exposure scenario. The carcinogenicity rating for TCE has been withdrawn, and a non-carcinogenic rating is pending. (USEPA,1994) (see Section 6.0 for further discussion on chemical carcinogenicity).

In the preamble of the proposed Subpart S regulation, EPA further stated that:

> "Groundwater that is not a potential source of drinking water would not require remediation to a 10^{-4} to 10^{-6} level. ....Finally, contaminated soil at an industrial site might be cleaned up to be sufficiently protective for industrial use but not residential use, as long as there is reasonable certainty that the site would remain industrial."

In March 1991, EPA issued a new guidance (USEPA, 1991B) on standard default exposure factors for risk assessment. In the new guidance, the lifetime exposure is defined as 30 years for a single location. EPA also reduced the exposure time from 365 days/year to 350 days/year. For industrial exposure, EPA suggested a daily water intake rate of 1 liter/day, at 250 days/year, for 25 years as lifetime exposure.

Using the above guidance with risk equations developed by EPA (1991A), the Maximum Allowable Exposure Concentration (MAEC) for PCB was calculated for different risk levels. A spreadsheet detailing the calculations is found in Appendix G. Using an oral slope factor of 7.7 $(mg/kg/day)^{-1}$ (USEPA,1994), the action levels for PCB by the water ingestion pathway are:

- 10^{-4} risk - 0.00111 mg/L; and
- 10^{-6} risk - 0.0000111 mg/L.

The Maximum Contaminant Level (MCL) for PCB is 0.0005 mg/L, which is between the 10^{-4} and 10^{-6} risk levels. Thus, the MCL presents a conservative MAEC for an industrial scenario, in which no groundwater is used for drinking, and no human habitation exists or is ever planned.

The MCL for TCE (0.005 mg/L) is used as the MAEC for water ingestion pathway scenarios.

9.2 Risk Characterization

Given the site conditions and no credible exposure scenario, risk from soil contamination cannot be determined (Section 7.1). The PCB contaminated soil is estimated to be about 37 yd^3, located 20 ft below the ground surface, and covered by either concrete or asphalt. This soil is unable to be excavated without complete destruction of the site property (Section 2.3). There is no exposure route or mechanism for chemical transport through the 20 ft of clean soil. Thus, risk from PCB contaminated soil, due to inhalation, ingestion, or dermal contact cannot be realistically assessed.

Risk from contaminated groundwater (PCB and TCE) can be considered by modeling the transport of contaminants from the site eastward to wells at the General Motors Plant and northward to the Missouri River, each of which are approximately 0.8 miles away. Figures 7-1 through 7-7 illustrate the potential impact to human receptors, as predicted by fate and transport modeling. No TCE or PCB contaminated groundwater is modeled to reach the wells or the Missouri River at concentrations greater than the MAECs.

The TCE groundwater plume, defined by the 0.005 mg/L MAEC, is presumed to have migrated from the source at the site to beyond the property boundary. Figures 7-1 through 7-4 show that in as little as 30 years from the present, the TCE will naturally attenuate below drinking water concentrations and will never reach a potential receptor. TCE contaminated groundwater is predicted to travel only about 150 meters, about one-tenth the distance to the wells, before dissipating below the 0.005 mg/L MAEC.

PCB has been found in some wells very close to the source, but its presence is believed to be due to either TCE coelution (the presumed method of vertical migration from the source) or faulty analytical procedures (samples were unfiltered). PCB contaminated groundwater, as modeled under a highly unlikely and conservative transport scenario (Section 7.5), is predicted to remain in the immediate site area. Figures 7-5 through 7-7 show model predictions indicating that even under highly conservative and unlikely conditions, PCB will not migrate beyond the site area. Site investigation results indicate PCB has not spread beyond the immediate source area (the "pit") (Section 5.4). There are no indications of PCB in any of the wells downgradient of the source.

One significant modeling assumption is that the source of contamination has been removed as of August, 1994. This has largely been achieved, with only an approximate 28 yd^3 of the source material remaining unexcavated. Because the Fairfax District is an area which is zoned Heavy Industrial only, and is likely to remain so long into the future, the relatively small amount of groundwater contamination from the site presents an insignificant risk to human health or the environment.

There is no known sensitive environmental receptor in the Fairfax District.

In conclusion, the remaining subsurface contamination resulting from operations at the site presents no significant risk to human or environmental receptors. Removal of the source material is sufficient to preclude any further contamination of the alluvial aquifer, and no further remedial activity is warranted to reduce risk to workers, the populace or the environment.

10.0 CONCLUSIONS

1. The Binkerhoff Road site is situated in the Central Lowlands Physiographic Province, and the topography is dominated by the floodplains and bluffs of the Missouri River. The first bedrock (Pleasanton) is relatively impermeable and about 70 ft thick at the site. The alluvial soils in the immediate Missouri floodplain can be broken down into three regions:
   - Upper 40% of vertical profile - silt, clay, and very fine sand;
   - Middle 40% - medium sand with interlayers of silt and coarse sand; and
   - Lower 20% - coarse sand and gravel.

2. Findings from the site investigation indicate that TCE has entered the groundwater and spread from the presumed source (the "pit" area) to the property boundaries, primarily in the eastward direction of groundwater flow. TCE concentrations range from 670 mg/L near the source to 0.088 mg/L near the east fenceline. TCE is being transformed to 1,2-DCE, which was found at most wells on the property. No free phase chemical was found.

3. PCB was detected at very low concentrations (≤ 0.023 mg/L) in the groundwater near the source; however, the levels may be due to sorbed PCB on soil particles. Groundwater samples were not filtered prior to analysis.

4. Remedial activities conducted at the site have removed all PCB contaminated surface material and over 90% of the PCB and TCE contaminated "pit" area, the source of the groundwater contamination. Complete destruction of the site and neighboring properties would be necessary to completely remove all the PCB contaminated soil.

5. The only credible exposure pathway to subsurface contamination is by water ingestion.

6. Results from fate and transport modeling indicate the TCE plume will move towards industrial wells located about 0.8 miles from the site. The forward edge of the TCE plume, as indicated by the 0.005 mg/L MAEC, will not move more than 150 m (500 ft) from the source. Therefore, the plume will not impact the downstream wells or any other point of reception.

7. Even under the highly conservative conditions for PCB transport (e.g., TCE coelution and high mass loadings), modeling results and field data indicate that PCB will not migrate toward any receptor.

8. Current land use at and near the site is zoned Heavy Industrial only. The entire Fairfax District is zoned as Heavy Industrial and is likely to remain so in the future. The Fairfax District encompasses the entire groundwater flow path from the site. There are no residential areas within the Fairfax District, and no groundwater from the Fairfax District is used for municipal purposes.

9. Based upon the results of this risk assessment and the fate and transport modeling, no further remedial action is warranted for the soil and groundwater in and around the Brinkerhoff Road facility.

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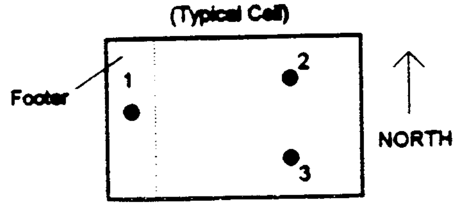
TABLES

Table 2-1
Soil Sampling
Results
(mg/kg)

	Pace Lab (EPA) At 13' Depth Below Footer		UNISON Lab (Split Sample)
Cell I	**TCE**	**PCB**	**PCB**
(1)	ND	ND	ND
(2)	24	49.3	85.8
(3)	13	<1.0	.5
X	12.4	16.8	28.8
S	9.8	23.0	40.3
* UCL	22.1	39.8	69.1
Cell II	**TCE**	**PCB**	**PCB**
(1)	ND	63.5	73.0
(2)	ND	0.1	BDL
(3)	.7	50.3	92.3
X	0.3	37.9	55.1
S	0.3	27.3	39.7
* UCL	0.6	65.3	94.8
Cell III	**TCE**	**PCB**	**PCB**
(1)	1.4	13	57.7
(2)	16	9.8	4.9
(3)	ND	55.3	68.6
X	5.8	26.0	43.7
S	7.2	20.7	27.8
* UCL	13.0	46.8	71.5

REFERENCE INFORMATION

Sample Orientation:
(Typical Cell)



Clean Up Criteria:

TCE < 60 ppm UCL(95%)

PCB < 10 ppm UCL(95%)

Table 3-1: Regional Pennsylvanian Stratigraphic Column

Group	Formation
Shawnee	Topeka Limestone Calhoun Shale Deer Creek Limestone Tecumseh Shale Lecompton Limestone Kanwaka Shale Oread Limestone
Douglas	Lawrence Shale Stranger Sandstone
Pedee	Weston Shale
Lansing	Stanton Limestone Vilas Shale Plattsburg Limestone
Kansas City	Bonner Springs Sandstone Wyandotte Limestone Lane Shale Iola Limestone Chanute Shale Drum Limestone Cherryvale Shale Dennis Limestone Galesburg Shale Swope Limestone Ladore Shale Hertha Limestone
Pleasanton	Tacket Shale Checkerboard Limestone Seminole Shale-Sandstone
Marmaton	Holdenville Shale Lenapah Limestone Nowata Shale Altamont Limestone Bandera Shale Pawnee Limestone Labette Shale Fort Scott Limestone
Cherokee	Cabaniss Shale-Sandstone Krebs Sandstone

modified after Hasan et al. (1988)

Table 4-1: Regional Bedrock Aquifer Quality And Yields

Bedrock Unit	Water Quality *	Yields (gpm)
Douglas, Lansing and Kansas City Groups	Fresh to slightly saline at depths <100ft, locally <250ft. Moderate to very saline >250ft depth	0-50, commonly less than 10
Pleasanton Group	Very saline	0-20
Marmaton Group	Very saline	0-150
Cherokee Group	Very saline or briny	0-200
Mississippian rocks	Very saline	50-500
Hunton Group, Viola Ls.	Very saline or briny	0-100
Simpson Group	Very saline or briny	0-300
Arbuckle Group, Lamotte ss	Very saline or briny	200-1,000

modified after O'Connor (1971)

* Key:

Fresh = < 1,000ppm dissolved solids
Slightly saline = 1,000 to 3,000 ppm dissolved solids
Moderately saline = 3,000 to 10,000 ppm dissolved solids
Very saline = 10,000 to 35,000 ppm dissolved solids
Briny = > 35,000 ppm dissolved solids

Table 4-2: Generalized/Average Regional Aquifer Characteristics

Aquifer Type	Soil/Glacial	Regional Bedrock	Alluvial
Yield (gpm)	0.3 - 3.0	0.02 - 20.0	200 - 2,500
Discharge (ft^3/day)	1,900 - 251,000	700 - 76,000	400 - 233,000
Transmissivity (ft^2/day)	100 - 84,000	4 - 7,500	400 - >400,000
Storage Coefficient (dim)	0.15 - 3.0×10^{-4}	0.15 - 8×10^{-4}	0.27 - 2.8×10^{-4}
Specific Capacity (gal/min/ft)	NA	0.45 - 111.0	14.0 -116.0

Table 4-3: Generalized Site/Near-Site Alluvial Aquifer Characteristics

Characteristic	Values
Yield (gpm)	80 - 1,580, Avg: 980
Transmissivity (gpd/ft)	400 - 825,000
Storage Coefficient (dim.)	0.27 - 2.8×10^{-4}
Specific Capacity (gal/min/ft)	13.3 - 375.0, Avg: 60
Permeability (gal/day/ft^2)	192 - 7,313
Hydraulic Conductivity (cm/sec)	9.0×10^{-3} - 3.4×10^{-1}
Recharge Rate (in)	5 - 15
Hydraulic Gradient (ft/mile)	4 - 5
Groundwater Velocity (ft/day)	4.2×10^{-3} (ML) - 3.70 (SP/GP)
Alluvium Thickness (ft)	65 - 145
Aquifer Thickness (sat. ft)	43 - 123
Bedrock Elevation (msl)	600 - 680
Surface Elevation (msl)	736 - 750

Table 4-4: Site Alluvial Aquifer Characteristics

Characteristic	Value
Surface Elevation (ft-msl)	745
Bedrock Elevation (ft-msl)	645
Alluvium Thickness (ft)	Upper (ML, SM) 60 Lower (SP, GP) 40
Aquifer Thickness (sat. ft)	Upper (ML,SM) 15 (23%) Lower (SP,GP) 65 (77%)
Hydraulic Gradient (ft/mile)	4
Yield (gpm)	1,000
Transmissivity (gpd/ft)	400,000
Storage Coefficient (dim.)	0.15
Specific Capacity (gal/min/ft)	60
Permeability (gal/day/ft^2)	Average: 5,000 Upper (ML,SM): 600 Lower (SP,GP): 6,015
Hydraulic Conductivity (ft/sec)	Average: 7.68×10^{-3} Upper (ML,SM): 9.21×10^{-4} Lower (SP,GP): 9.24×10^{-3}
Groundwater Velocity (ft/day)	2.02 (SP)

Table 4-5: Characteristics Of Floodplain Soils*

U.S.C.	Alluvium Name	Hydraulic Conductivity (K, cm/sec)
GW/SP	Well graded gravels or gravel-sand mixtures, little or no fines	10^{-2}
SP	Poorly graded sands or gravelly sands, little or no fines	10^{-3}
SM	Silty sands, sand-silt mixtures	10^{-3} to 10^{-6}
SC	Clayey sands, sand-clay mixtures	10^{-6} to 10^{-8}
ML	Inorganic silts and very fine sands, silty or clayey fine sands or clayey silts	10^{-3} to 10^{-6}
CL	Low to medium plastic inorganic clays, gravelly clays, sandy clays, silty clays	10^{-6} to 10^{-8}
CH	Highly plastic inorganic clays	10^{-6} to 10^{-8}

* after Crabtree and Malone (1984)

Table 5-1: Well/Piezometer Data

Boring/Well/ Piezometer Number	Surface Elevation (msl)	Boring Depth (ft)	Screen Depth (ft)	Elev (msl)	Length (ft)	Surface Finish
S-1	745	60	N/A			None-sealed
PZ-1	744	32	32	712	20	flush mount
PZ-2	745	32	32	713	20	Steel casing
PZ-3	748	33	32	716	10	flush mount
PZ-4	744	33	32	712	10	flush mount
MW-11A	740	28	25	715	10	riser pipe
MW-12A	744	33	30	714	10	riser pipe
MW-12B	744	54	49	695	10	riser pipe
MW-13A	745	33	30	715	10	flush mount
MW-13B	745	54	49	696	10	flush mount
MW-14A	745	32	30	715	10	flush mount

Table 5-2: Groundwater Elevations

Well/Piezometer	Elevation* (ft-msl)
PZ-1	727.50
PZ-2	727.64
PZ-3	727.63
PZ-4	727.54
MW-11A	727.64
MW-12A	727.59
MW-12B	727.60
MW-13A	727.63
MW-13B	727.63
MW-14A	727.61

* Measurement date - May 19, 1994

Table 5-3: Summary Of Analytical Laboratory Results

Well Number	Analyte	Result (mg/L)	MDL (mg/L)
PZ-1	Trichloroethylene	2.4	0.1
	1,2-Dichloroethylene	2.1	0.1
PZ-2	Trichloroethylene	25.0	2.5
	1,2-Dichloroethylene	ND	2.5
PZ-3	Trichloroethylene	4,100	0.25
	1,2-Dichloroethylene	0.29	0.25
PZ-4	Trichloroethylene	0.088	0.005
	1,2-Dichloroethylene	0.013	0.005
MW-11A	Trichloroethylene	360.0	10.0
	1,2-Dichloroethylene	120.0	10.0
	Aroclor 1242	0.0016	0.001
	Aroclor 1260	0.0039	0.001
MW-12A	Trichloroethylene	96.0	5.0
	1,2-Dichloroethylene	69.0	5.0
MW-12B	Trichlorethylene	17.0	1.2
	1,2-Dichloroethylene	8.7	1.2
MW-13A	Trichlorethylene	670.0	20.0
	1,2-Dichloroethylene	ND	20.0
	Aroclor 1260	0.023	0.005
MW-13B	Trichloroethylene	11.0	0.25
	1,2-Dichloroethylene	ND	0.25
	Aroclor 1260	0.0018	0.001
MW-13B Dup	Trichlorethylene	37.0	1.2
	1,2-Dichloroethylene	24.0	1.2
	Aroclor 1260	0.0011	0.001
MW-14A	Trichloroethylene	9.6	0.25
	1,2-Dichloroethylene	ND	0.25

MDL = method detection limit; ND = not detected

Table 6-1: PCB Chemical/Physical Properties*

Property	Value
Molecular Weight	324 to 460, average = 370 g/mole
Appearance	light yellow sticky resin
Henry's Law Constant	0.0071 atm·m^3/mol
Log K_{OC}	6.42
Log K_{OW}	6.91
Solubility in Water	0.080 mg/L at 24°C
Vapor Pressure	4.0 x 10^{-5} mm at 25°C

Table 6-2: TCE Chemical/Physical Properties*

Property	Value
Molecular Weight	131.4 g/mole
Henry's Law Constant	0.01 atm·m^3/mol
Log K_{OC}	2.0
Log K_{OW}	2.4
Solubility in Water	1100 mg/L at 25°C
Specific Density	1.46
Vapor Pressure	74 mm at 25°C
Biodegradation Rate (1/day)	0.0014

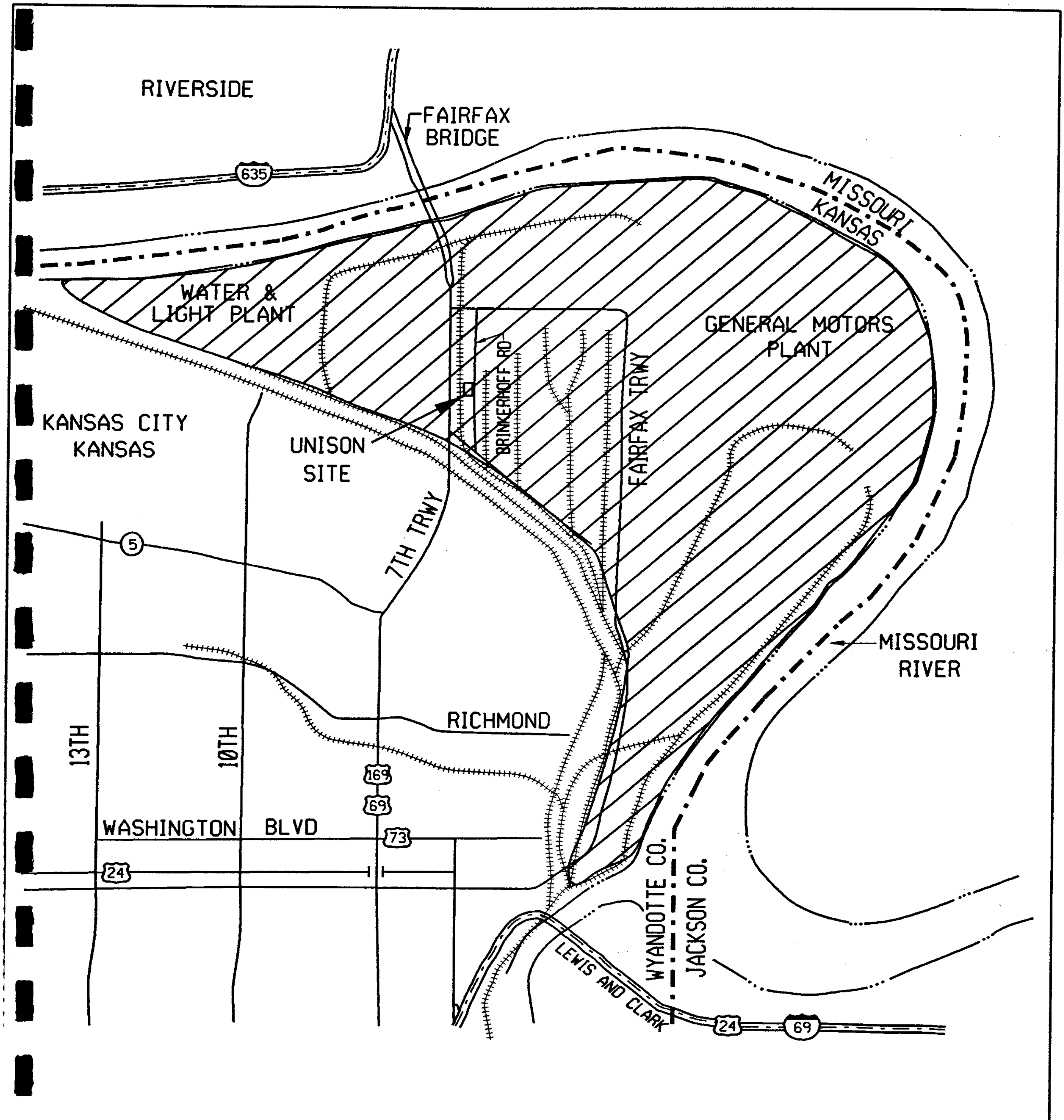
* from Montgomery and Welkom (1990)

Table 7-1: RISKPRO, AT123D Model Inputs

Source	Continuous
Aquifer Width	Infinite
Aquifer Depth	24.4 m
Source Width	3.05 m
Source Length	15.55 m
Hydraulic Gradient	0.000758 ft/ft
Hydraulic Conductivity	0.36 m/hr
Effective Porosity	0.28
Longitudinal Transmissivity	4
Transverse Transmissivity	4
Vertical Transmissivity	1
Soil Organic Carbon Content	0.1%
Model Run Time	75 yrs
K_D - TCE	0.0001 m^3/kg
K_D - PCB	0.00526 m^3/kg
Molecular Diffusion (TCE and PCB)	0 m^2/hr
Decay Constant - TCE	0.0000593 /hr
Soil Bulk Density	1350 kg/m^3
Release Rate* - TCE	0.015 kg/hr
Release Rate* - PCB	0.00015 kg/hr
PCB:TCE at Source Release	1:100

* 1983 to 1994

FIGURES



FAIRFAX INDUSTRIAL DISTRICT

NO	REVISION	DATE	BY	CK'D	APV'D
		8-2-94			

DRAWN BY: R.Price | CHECKED BY: | ENGINEER: | DATE: 7-28-94

UNION CARBIDE CORPORATION

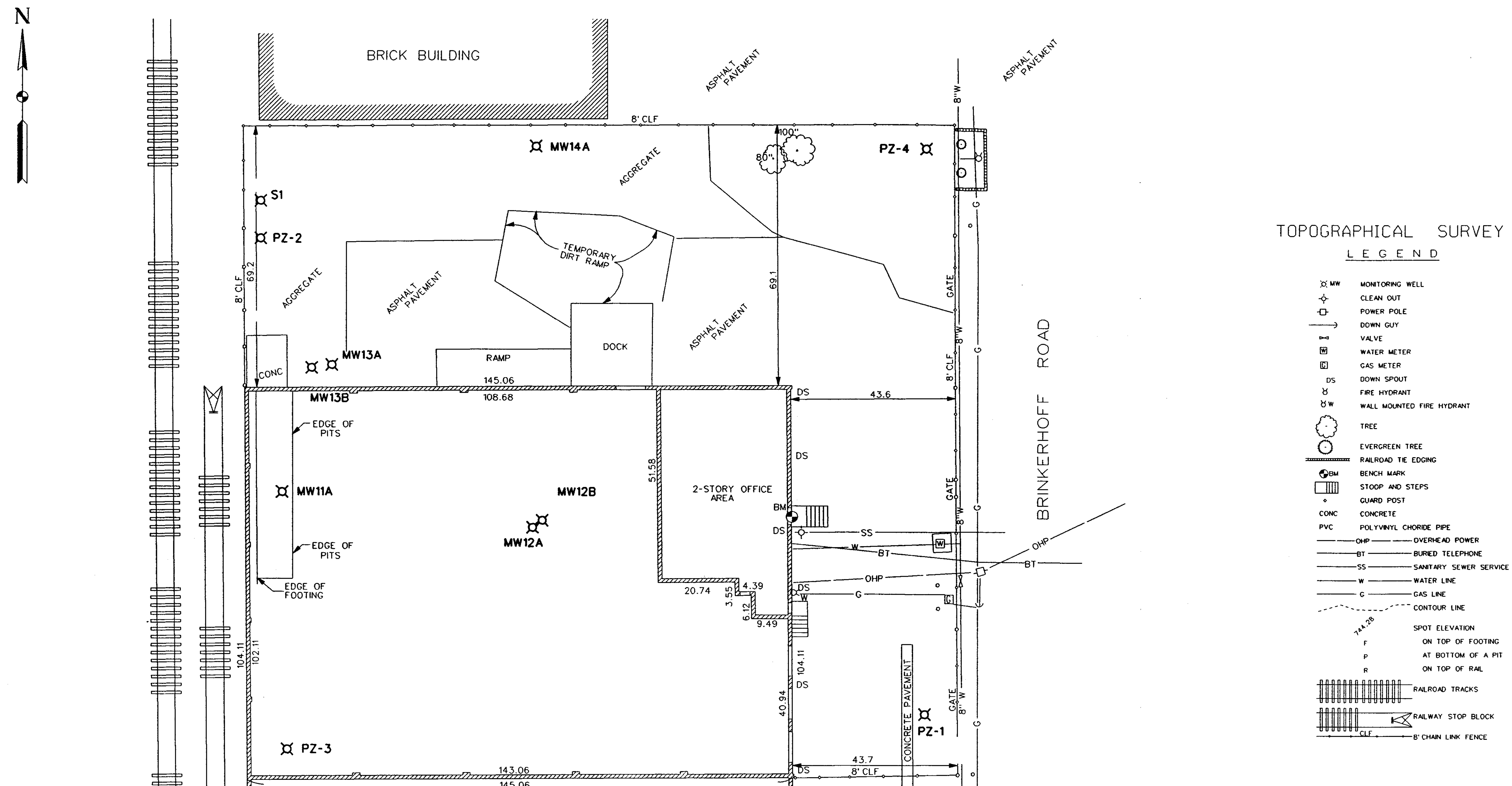
UNIT: | 930- | SCALE:

FIGURE 2-1
FAIRFAX DISTRICT
KANSAS CITY, KANSAS

JOB NUMBER | UNIT SYMBOL | ZONE | AREA

FLAG(S) | CAD SAVE NAME: AAZWZ.DGN | SIZE | REV

LOC | SITE | SUBJ | DRAWING NUMBER | SHEET



NO	REVISION	DATE	BY	CK'D	APV'D

DRAWN BY	CHECKED BY	ENGINEER	DATE
R.Price			7-28-94

UNION CARBIDE CORPORATION

UNIT | 930- | SCALE

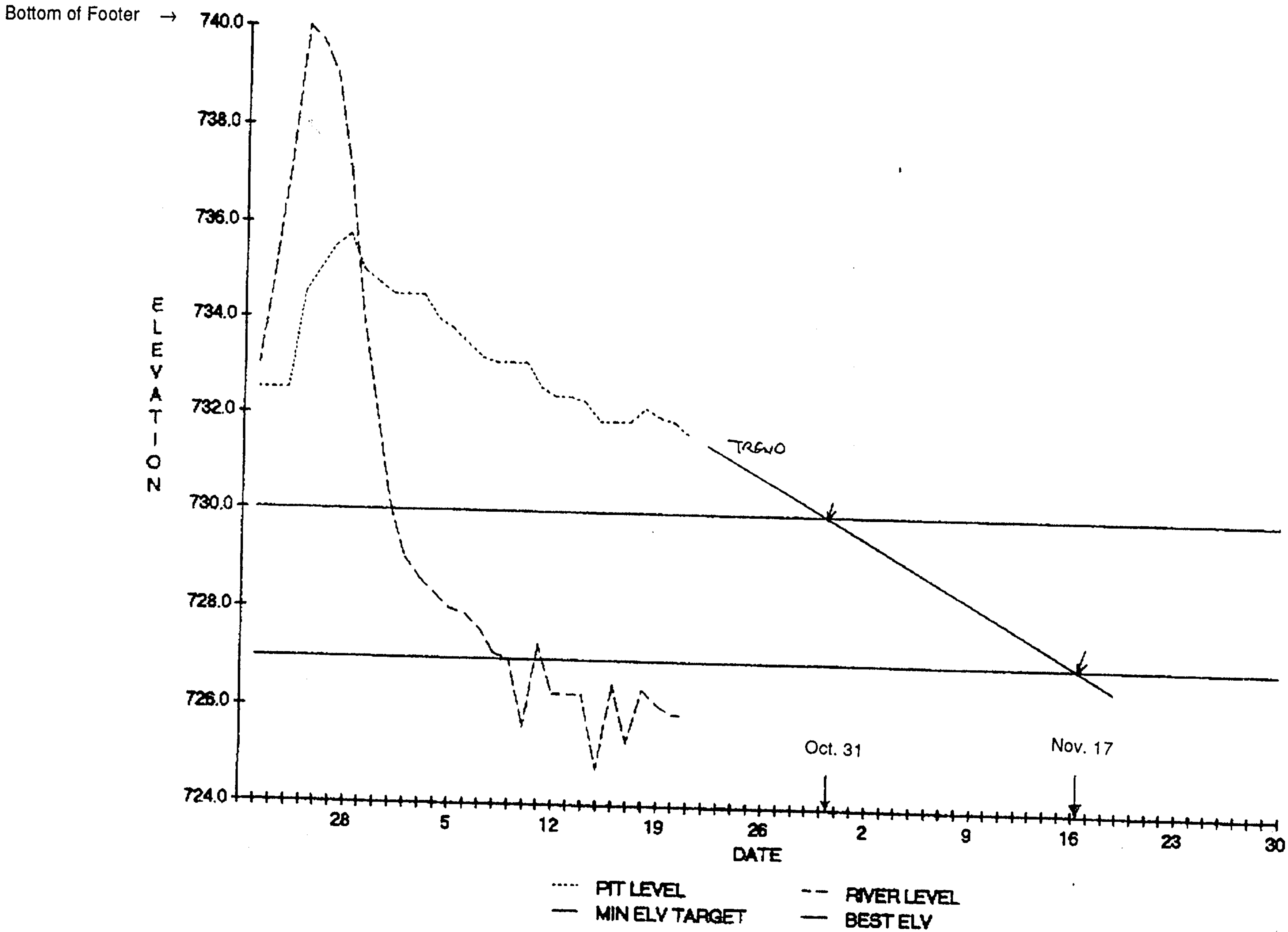
FIGURE 2-2
UNISON TRANSFORMER SERVICES, INC.
3126 BRINKERHOFF ROAD

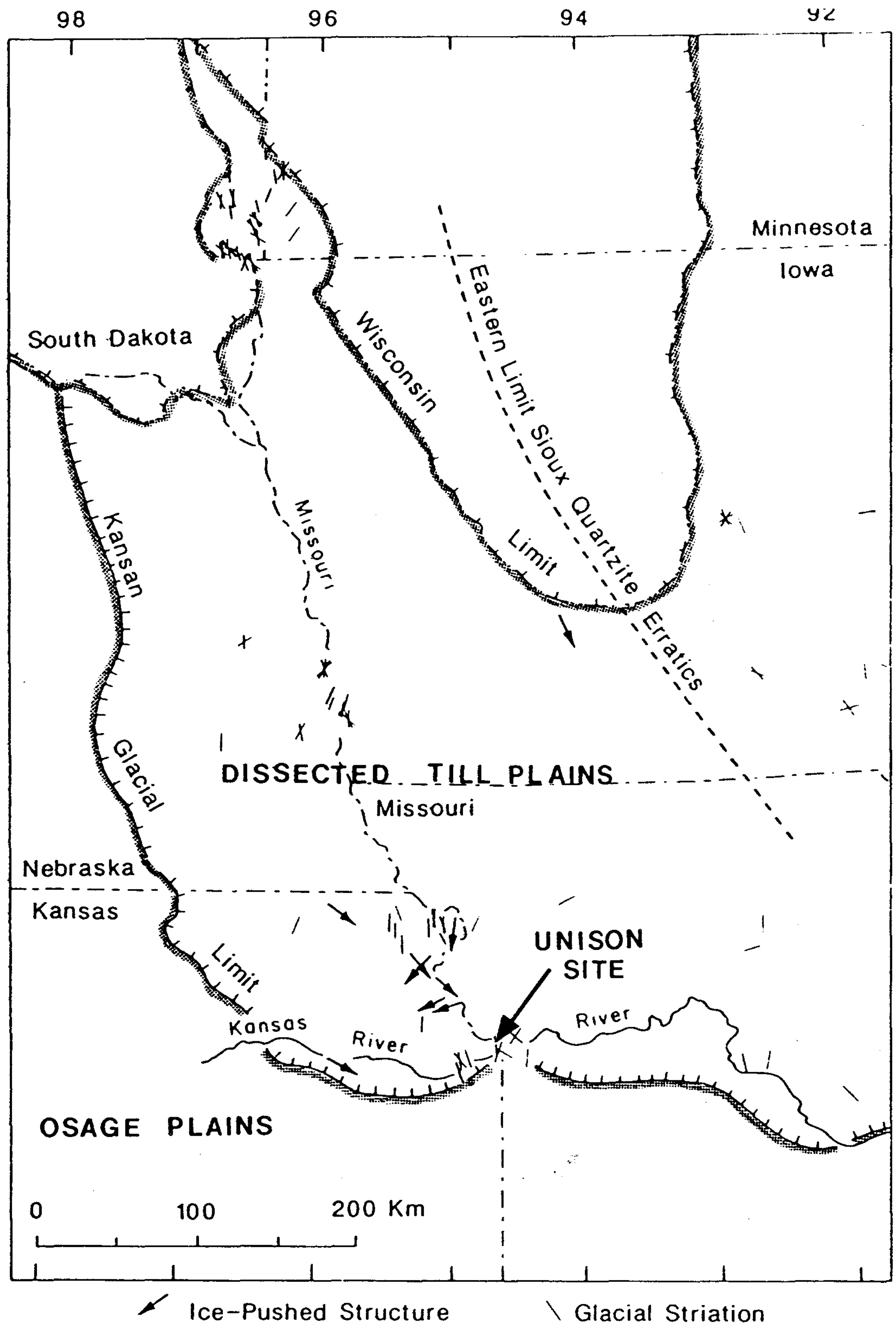
JOB NUMBER | UNIT SYMBOL | ZONE | AREA

FLAG(S) | CAD SAVE NAME AAZXA.DGN | SIZE | REV

LOC | SITE | SUBJ | DRAWING NUMBER | SHEET

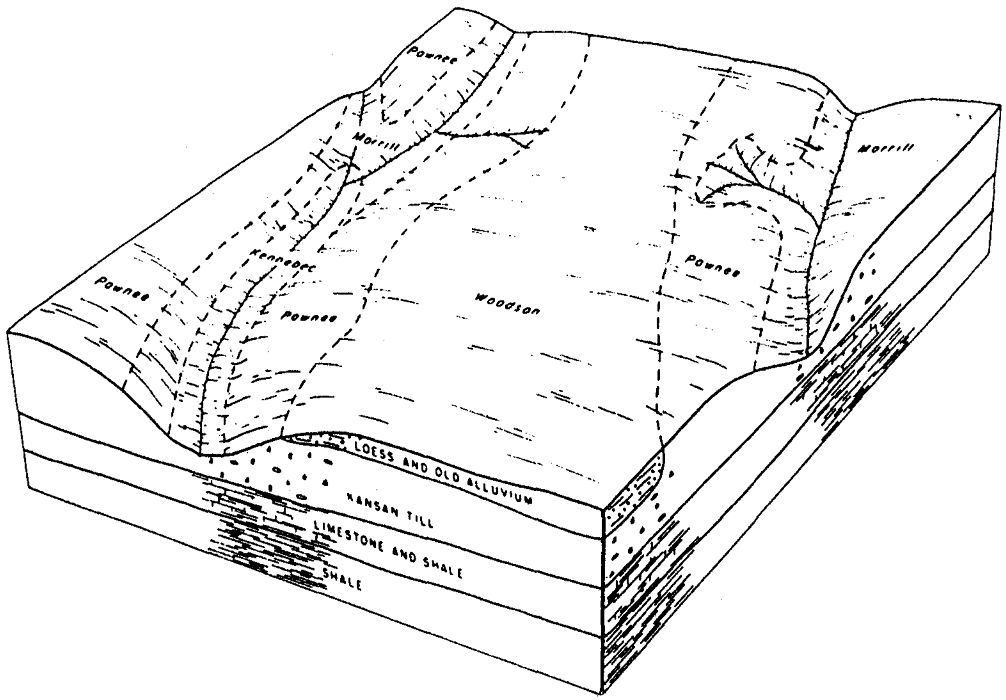
Figure 2-3
Title: Missouri River, Groundwater Elevations





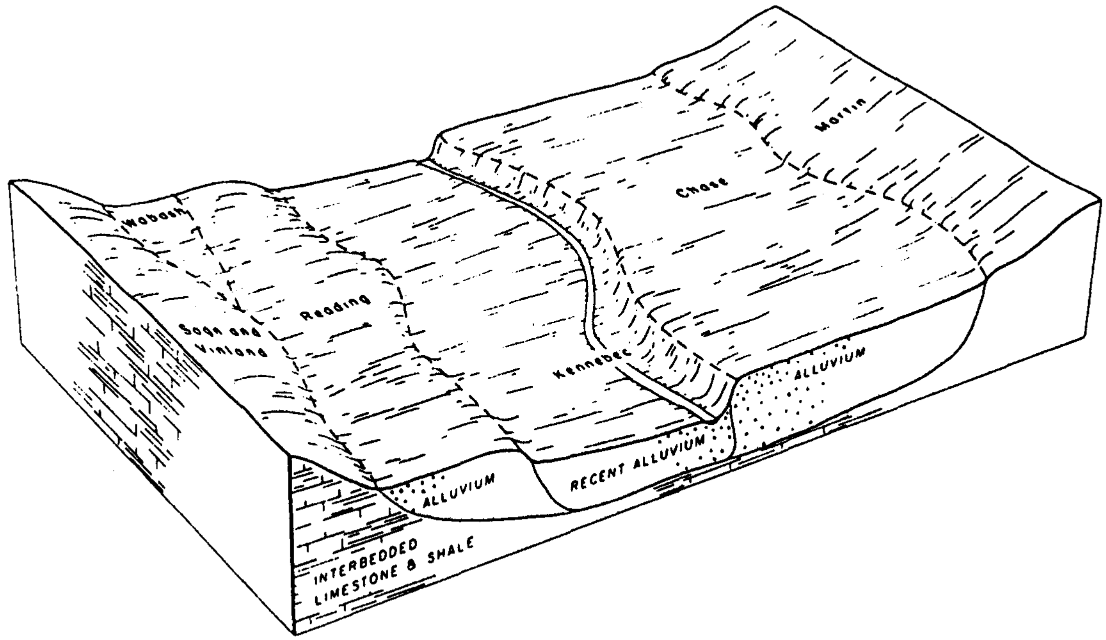
UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
Regional Physiographic Subprovinces and Glacial Limits				
Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001.0	MMK	MMK	6/28/94	3-1

ort (1987)



Plinsky et al. (1979)

UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
Regional Soil Profile				
Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001.0	MMK	MMK	6/28/94	3-2



Plinsky et al. (1979)

UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
Alluvial Soil Profile				
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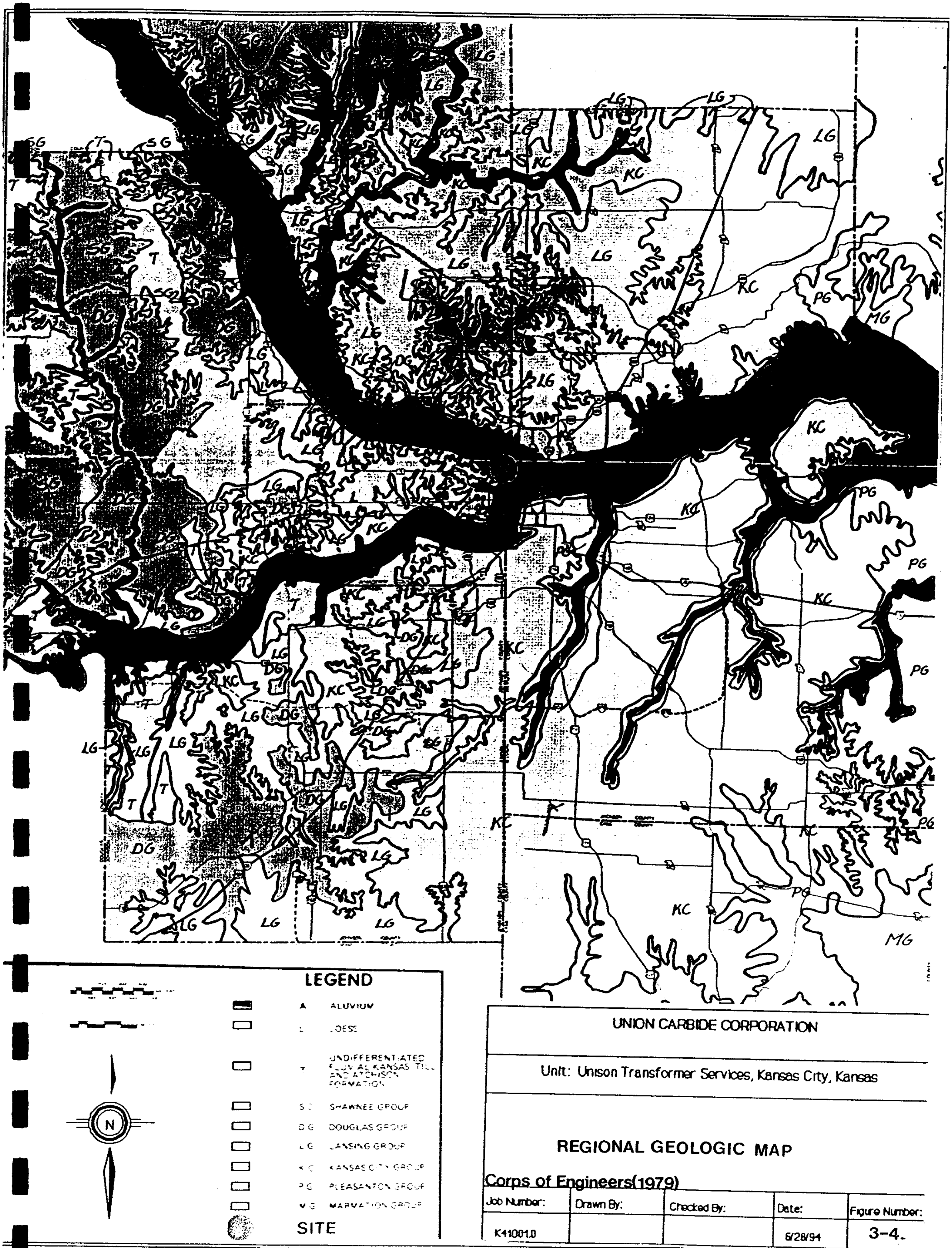
K41001.0	MMK	MMK	6/28/94	3-3



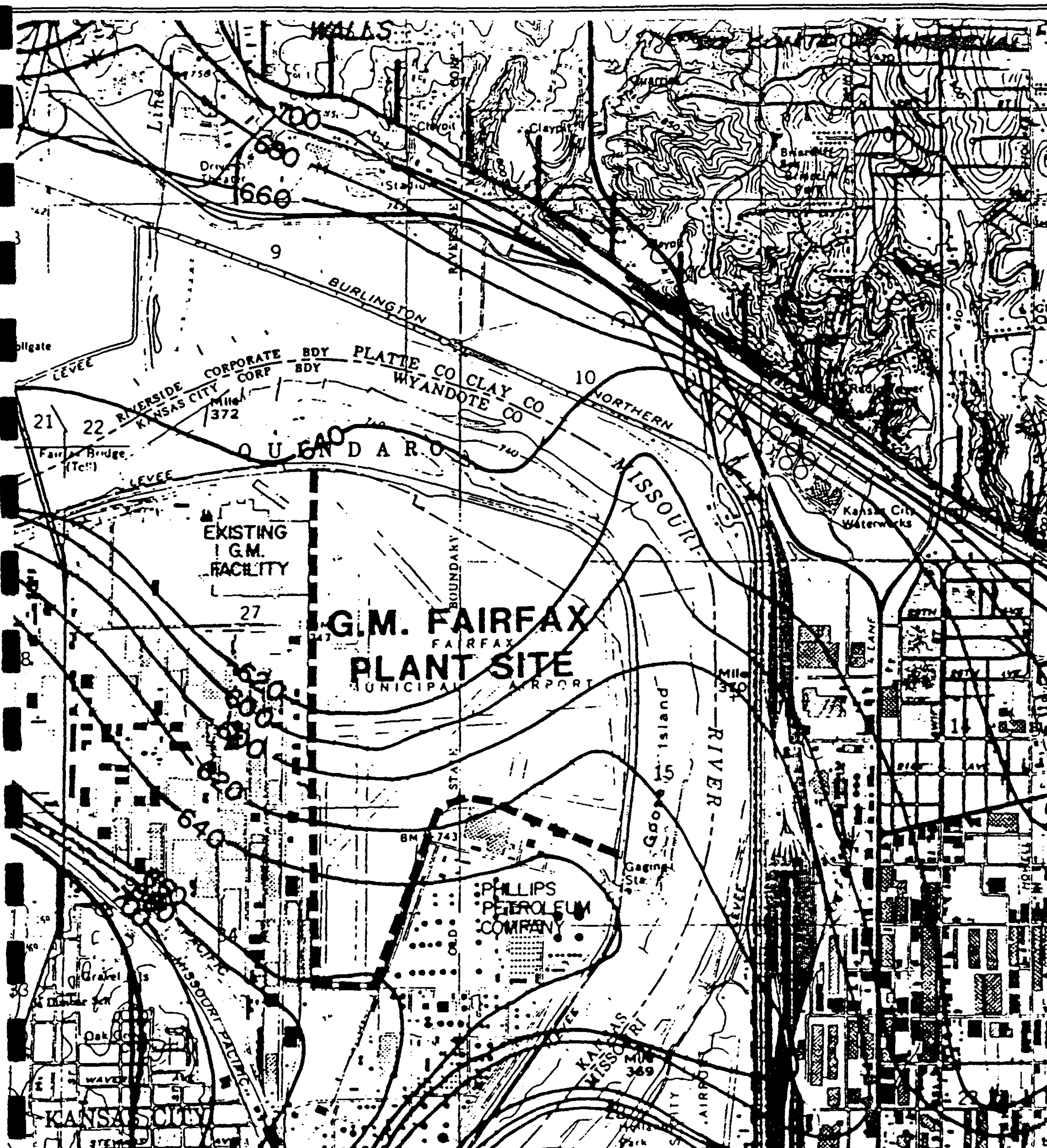
UNION CARBIDE CORPORATION

Unit: Unison Transformer Services, Kansas City, Kansas

REGIONAL GEOLOGIC MAP

Corps of Engineers(1979)

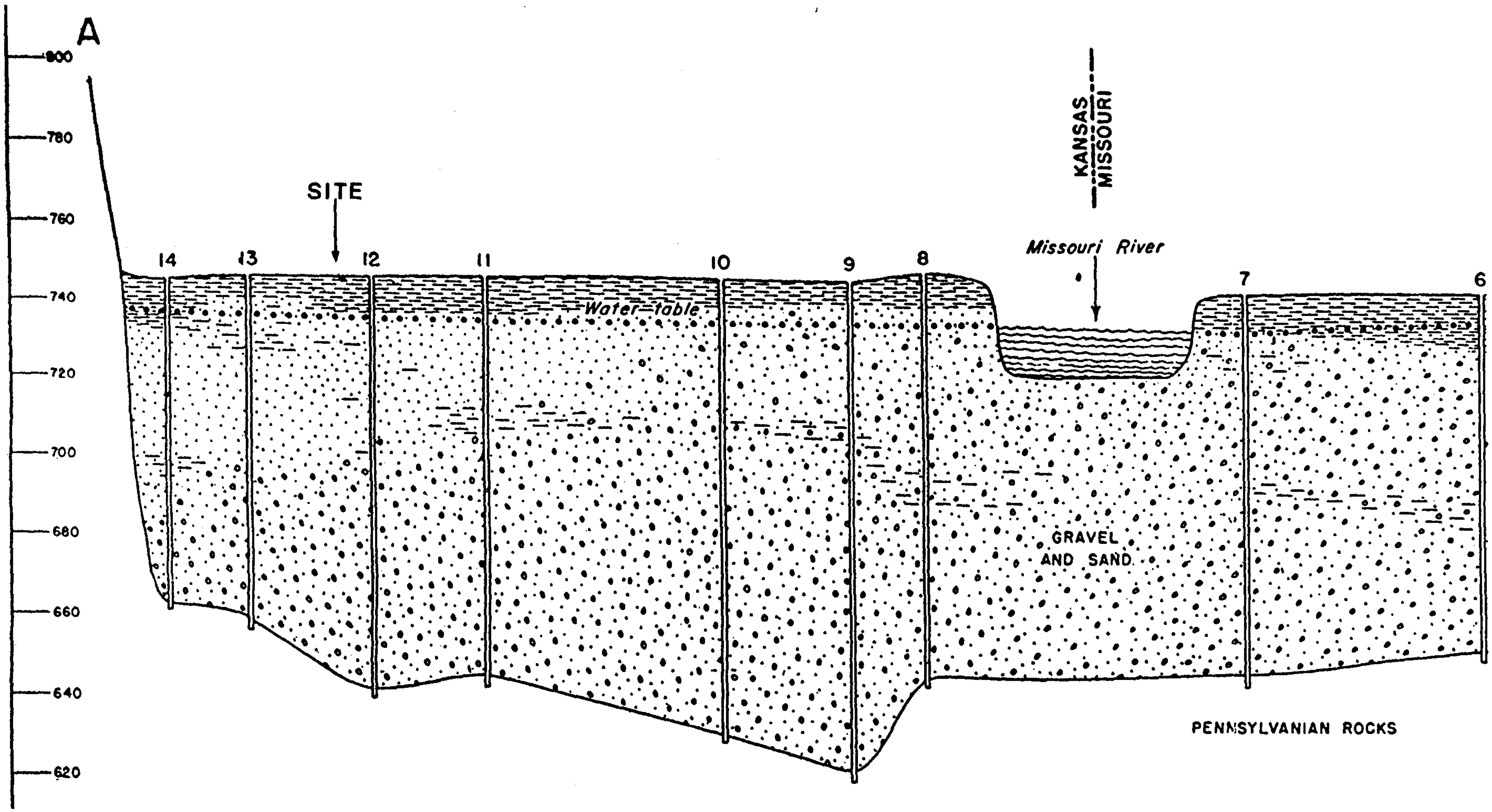
Job Number:	Drawn By:	Checked By:	Date:	Figure Number:
K41001.0			6/28/94	3-4.



UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
Bedrock Topography				
Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001.0	MMK	MMK	6/28/94	FIGURE 3-5

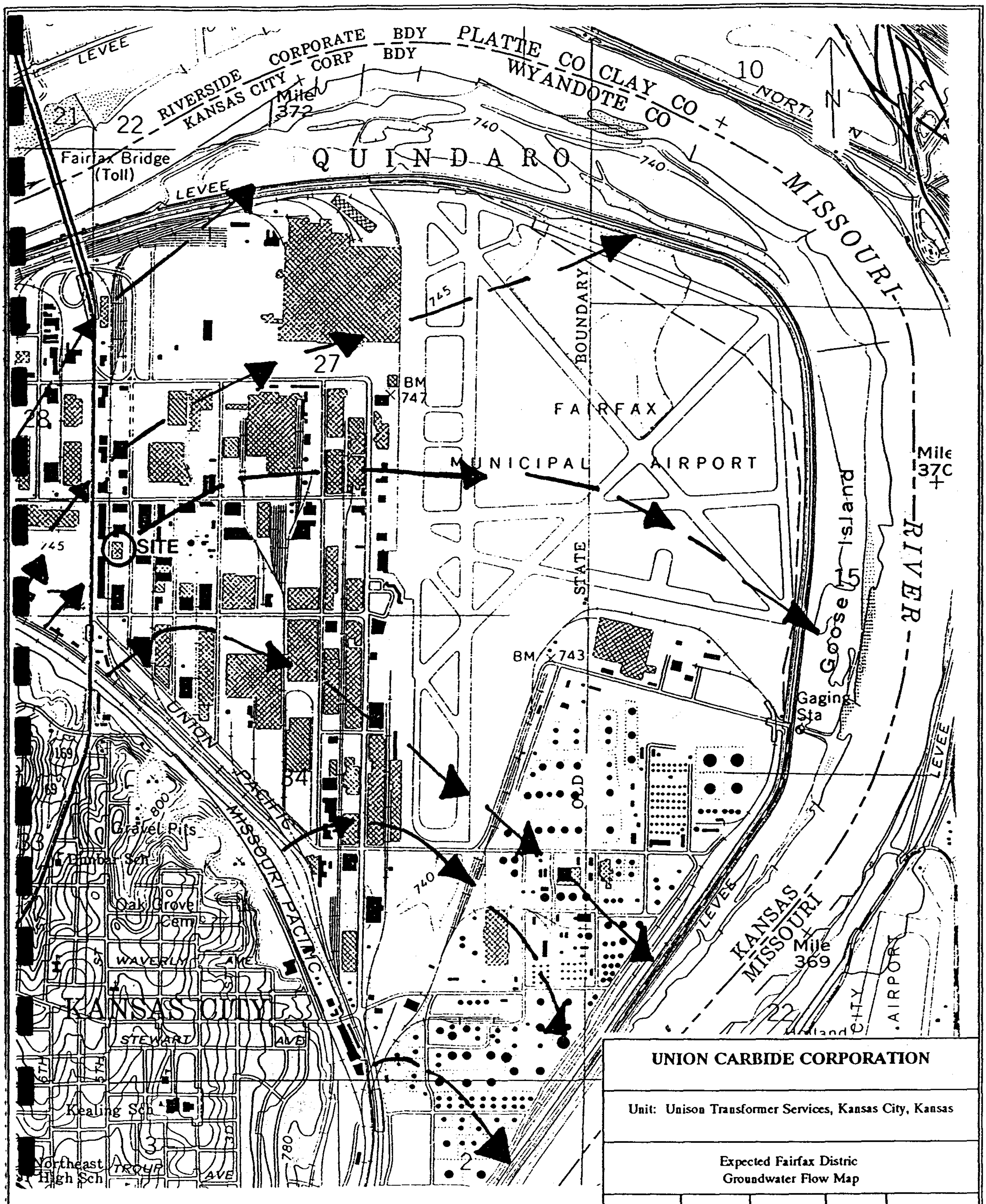
N

Meyer, et al., 1985



State Geological Survey of Kansas

UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
Near-Site Alluvial Cross-Section				
Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001.0	MMK	MMK	6/28/94	FIGURE 3-6



Groundwater Flow

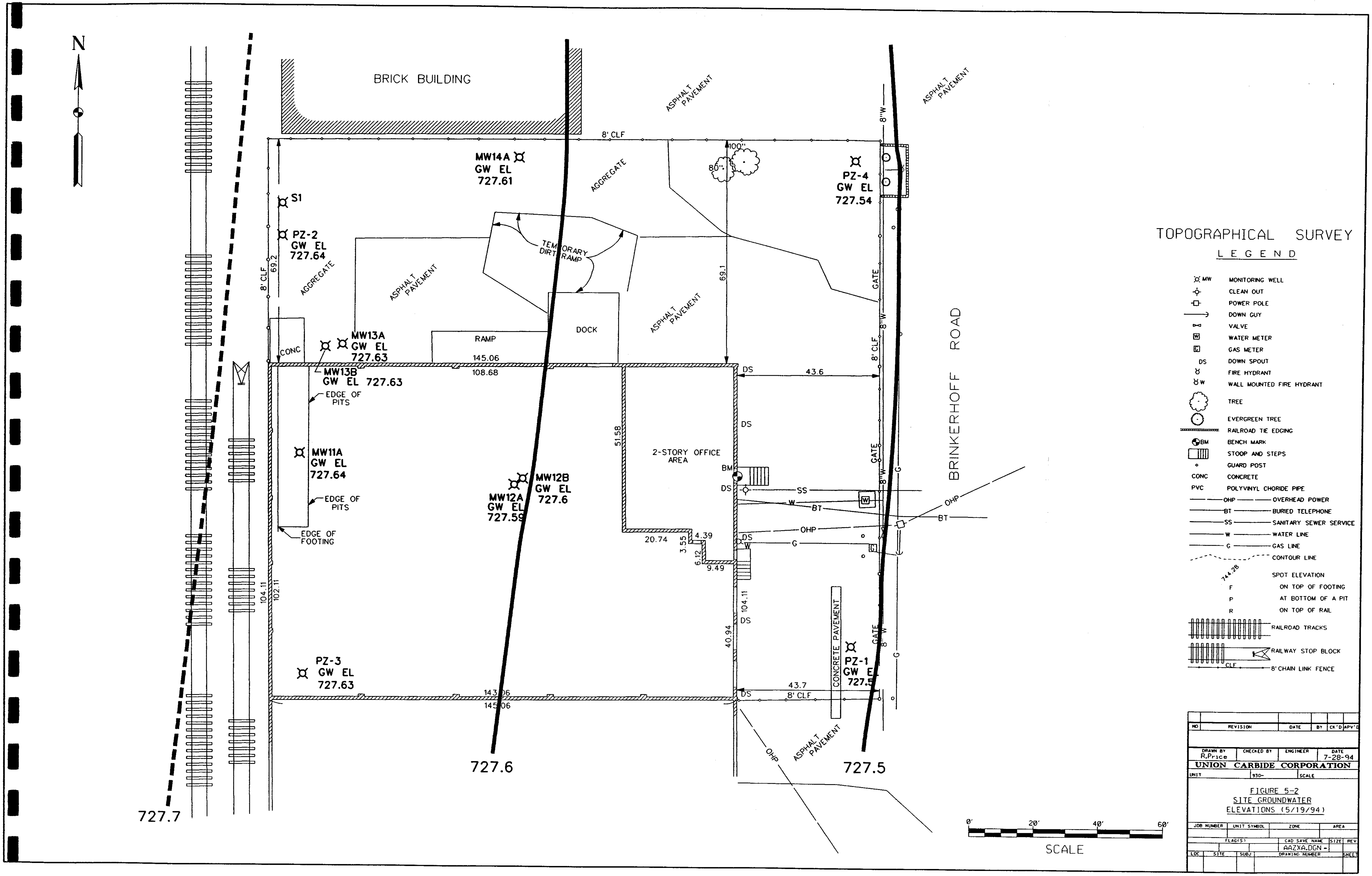
United States Geological Survey Topographic Map, North Kansas City Quadrangle, 1975

UNION CARBIDE CORPORATION

Unit: Unison Transformer Services, Kansas City, Kansas

Expected Fairfax Distric
Groundwater Flow Map

Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001.0	MMK	MMK	6/28/94	FIGURE 5-1



N
BRICK BUILDING
ASPHALT PAVEMENT
8' CLF
MW14A
GW EL
727.61
AGGREGATE
PZ-4
GW EL
727.54
S1
PZ-2
GW EL
727.64
TEMPORARY DIRT RAMP
69.2
69.1
RAMP
DOCK
CONC
MW13A
GW EL
727.63
MW13B
GW EL 727.63
145.06
108.68
43.6
EDGE OF PITS
MW11A
GW EL
727.64
EDGE OF FOOTING
MW12B
GW EL
727.6
MW12A
GW EL
727.59
51.58
2-STORY OFFICE AREA
BM
DS
SS
W
BT
OHP
G
GATE
8"W
20.74
4.39
3.55
6.12
9.49
104.11
102.11
40.94
CONCRETE PAVEMENT
PZ-3
GW EL
727.63
PZ-1
GW EL
727.5
43.7
143.06
145.06
BRINKERHOFF ROAD
727.7
727.6
727.5
TOPOGRAPHICAL SURVEY
LEGEND
MW MONITORING WELL
CLEAN OUT
POWER POLE
DOWN GUY
VALVE
WATER METER
GAS METER
DS DOWN SPOUT
FIRE HYDRANT
W WALL MOUNTED FIRE HYDRANT
TREE
EVERGREEN TREE
RAILROAD TIE EDGING
BM BENCH MARK
STOOP AND STEPS
GUARD POST
CONC CONCRETE
PVC POLYVINYL CHORIDE PIPE
OHP OVERHEAD POWER
BT BURIED TELEPHONE
SS SANITARY SEWER SERVICE
W WATER LINE
G GAS LINE
CONTOUR LINE
744.28 SPOT ELEVATION
F ON TOP OF FOOTING
P AT BOTTOM OF A PIT
R ON TOP OF RAIL
RAILROAD TRACKS
RAILWAY STOP BLOCK
CLF 8' CHAIN LINK FENCE
0' 20' 40' 60'
SCALE
NO REVISION DATE BY CK'D APV'D
DRAWN BY R.Price
CHECKED BY
ENGINEER
DATE 7-28-94
UNION CARBIDE CORPORATION
UNIT 930- SCALE
FIGURE 5-2
SITE GROUNDWATER
ELEVATIONS (5/19/94)
JOB NUMBER UNIT SYMBOL ZONE AREA
FLAG(S) CAD SAVE NAME AAZXA.DGN SIZE REV
LOC SITE SUBJ DRAWING NUMBER SHEET

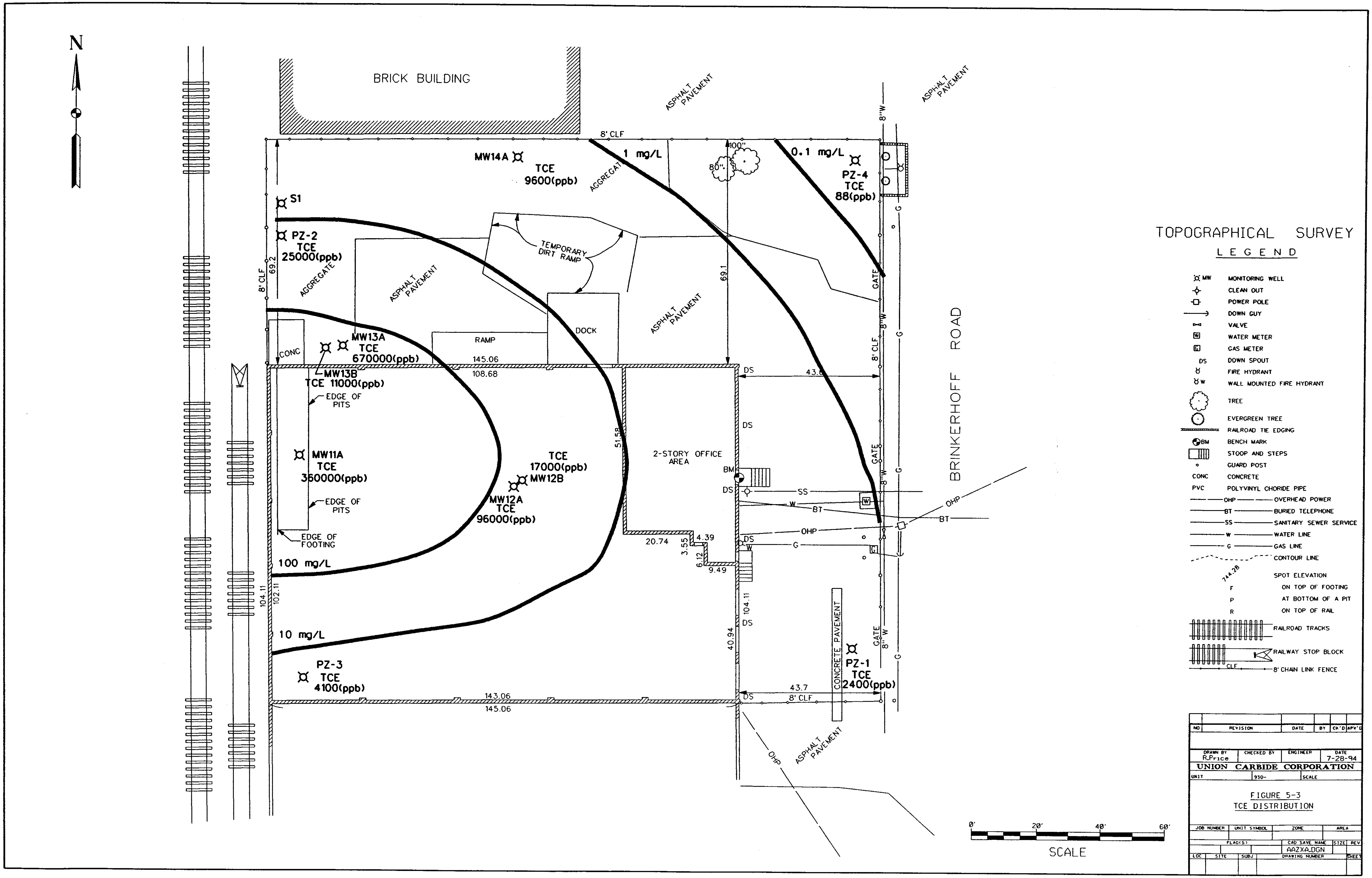
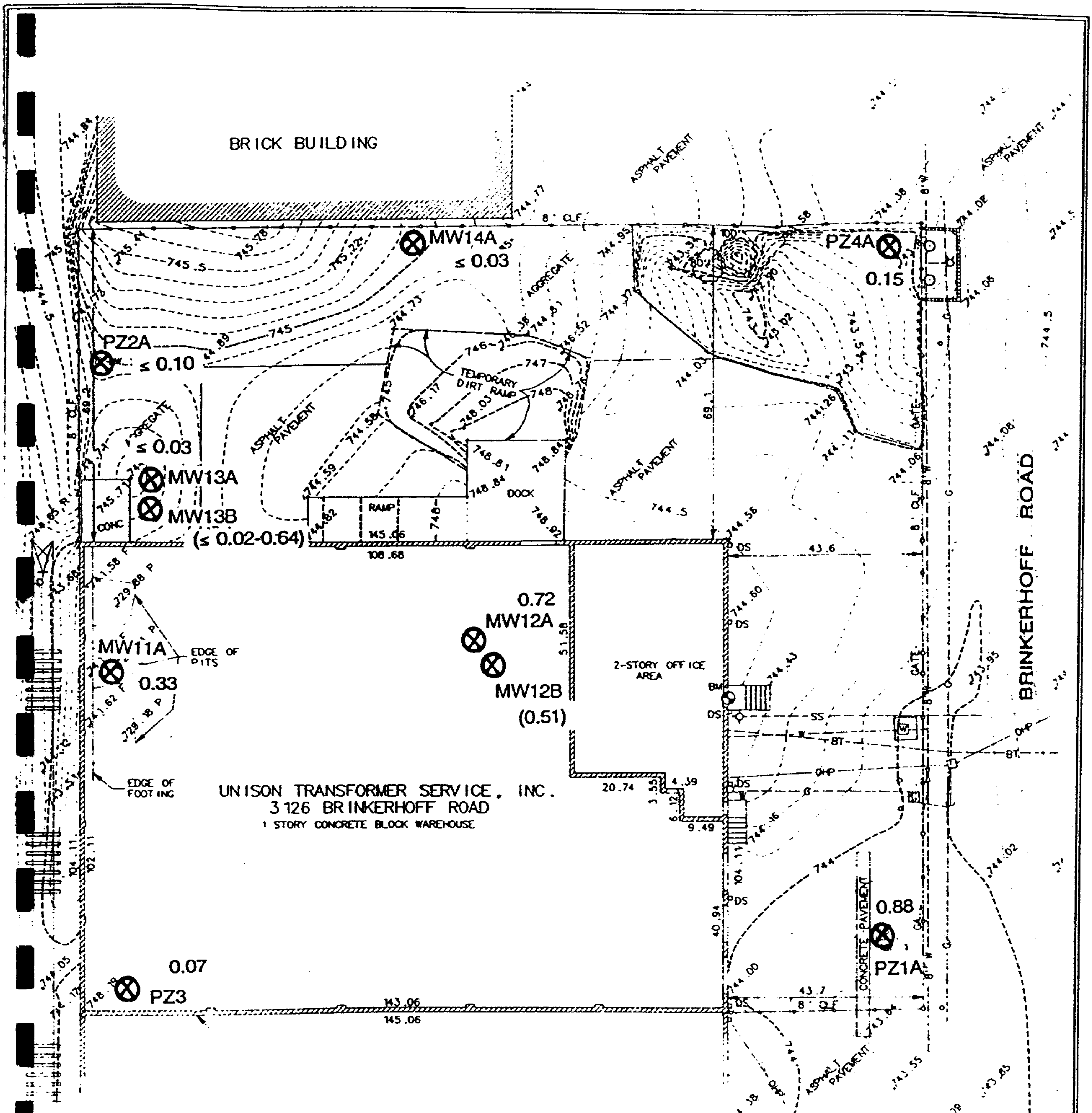


FIGURE 5-3
TCE DISTRIBUTION



A = Shallow (30') wells
B = Deep (60') wells

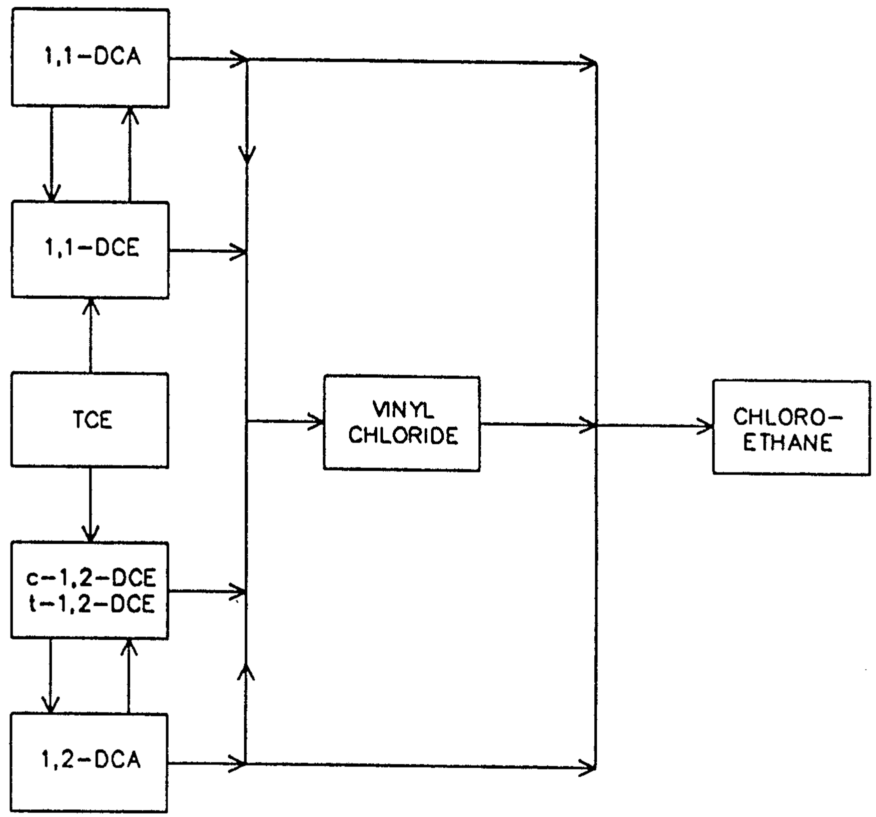
Ratio of 1, 2-DCE to TCE
0.33 ratio of DCE:TCE in shallow well.
(10) ratio of DCE:TCE in deep well.

UNION CARBIDE CORPORATION				
Unit: Unison Transformer Services, Kansas City, Kansas				
DCE/TCE Ratios				
Job Number:	Drawn by:	Checked by:	Date:	Figure Number:
K41001	MMK	MMK	6/28/94	FIGURE 5-4

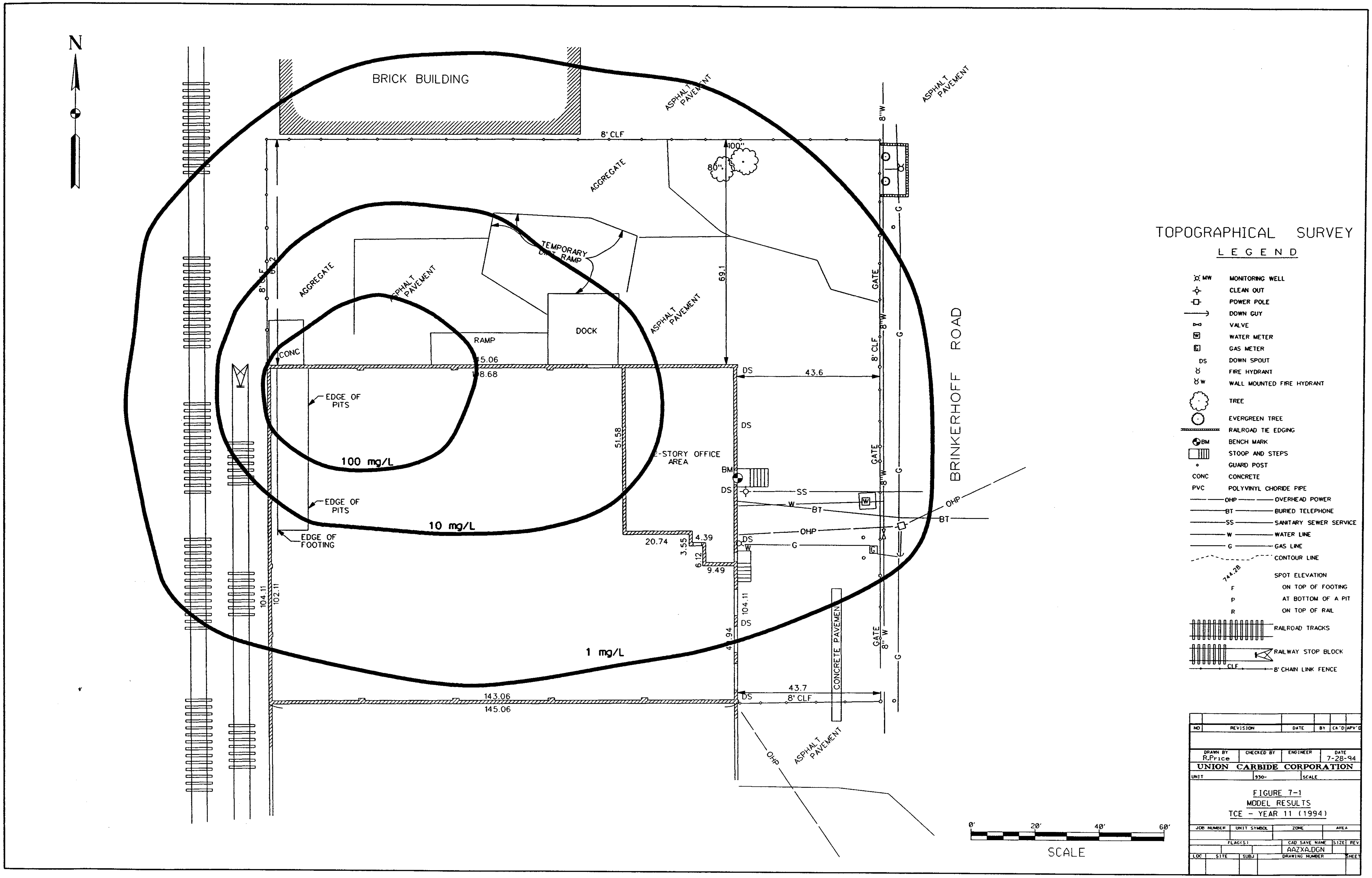
Roger L. Brenizer & Associates, 1994

Figure 6-1:

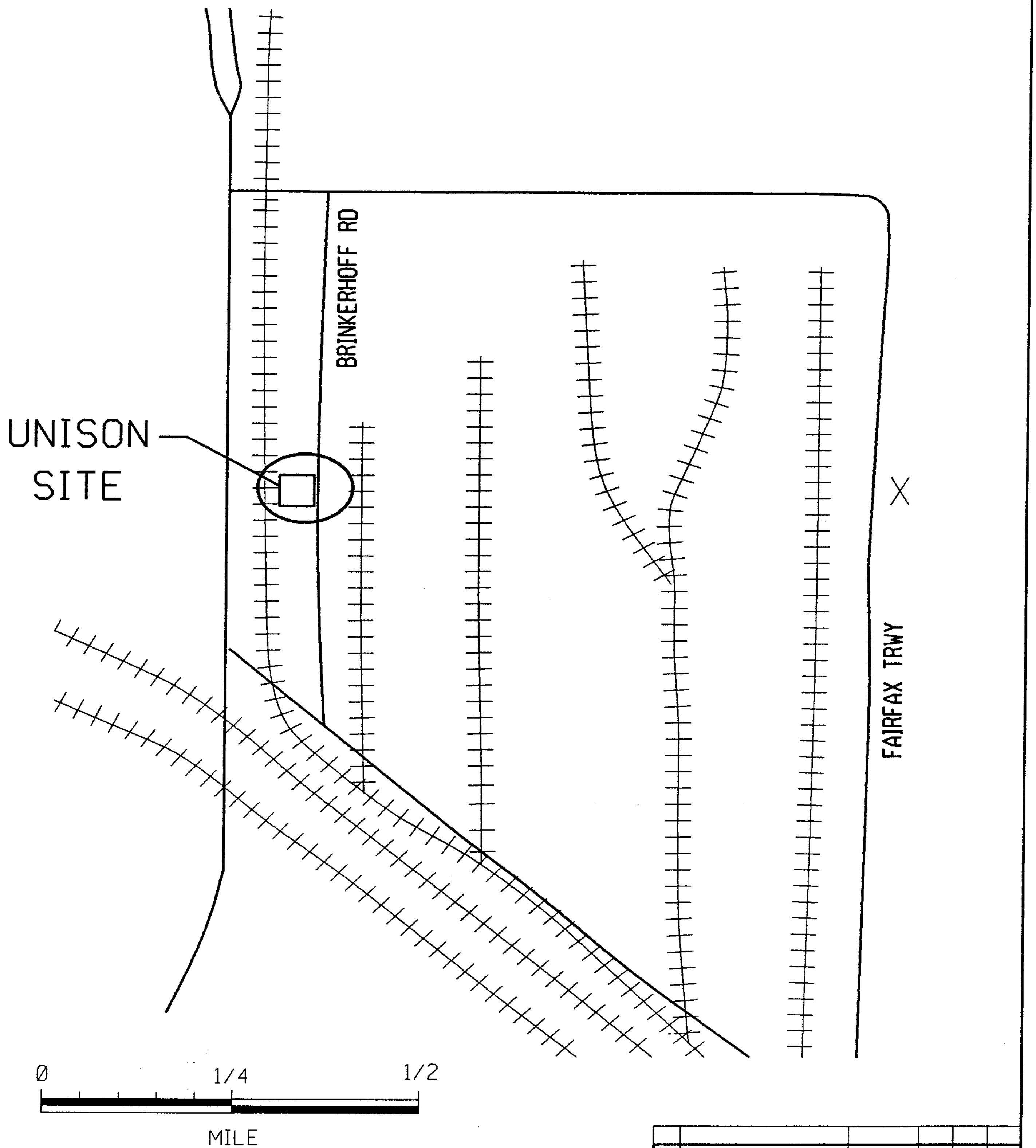
TCE DEHALOGENATION



Transformation pathways for various chlorinated volatile hydrocarbons in soil systems.



N
BRICK BUILDING
ASPHALT PAVEMENT
ASPHALT PAVEMENT
8' CLF
100"
80"
AGGREGATE
TEMPORARY DIRT RAMP
AGGREGATE
ASPHALT PAVEMENT
ASPHALT PAVEMENT
69.1
DOCK
RAMP
CONC
145.06
148.68
DS
43.6
EDGE OF PITS
100 mg/L
51.58
2-STORY OFFICE AREA
BM
DS
SS
W
BT
OHP
EDGE OF PITS
10 mg/L
EDGE OF FOOTING
20.74
4.39
3.55
6.12
9.49
G
104.11
102.11
104.11
1 mg/L
CONCRETE PAVEMENT
GATE
8" W
8' CLF
BRINKERHOFF ROAD
43.7
143.06
145.06
ASPHALT PAVEMENT
SCALE
0'
20'
40'
60'
TOPOGRAPHICAL SURVEY
LEGEND
MONITORING WELL
CLEAN OUT
POWER POLE
DOWN GUY
VALVE
WATER METER
GAS METER
DOWN SPOUT
FIRE HYDRANT
WALL MOUNTED FIRE HYDRANT
TREE
EVERGREEN TREE
RAILROAD TIE EDGING
BENCH MARK
STOOP AND STEPS
GUARD POST
CONCRETE
POLYVINYL CHORIDE PIPE
OVERHEAD POWER
BURIED TELEPHONE
SANITARY SEWER SERVICE
WATER LINE
GAS LINE
CONTOUR LINE
SPOT ELEVATION
ON TOP OF FOOTING
AT BOTTOM OF A PIT
ON TOP OF RAIL
RAILROAD TRACKS
RAILWAY STOP BLOCK
8' CHAIN LINK FENCE
DRAWN BY R.Price
DATE 7-28-94
UNION CARBIDE CORPORATION
FIGURE 7-1
MODEL RESULTS
TCE - YEAR 11 (1994)
AAZXA.DGN



GENERAL NOTES

CONTOUR = 0.005 mg/L TCE

X = ASSUMED WELL INTAKE POINT AT GENERAL MOTORS PLANT

NO	REVISION	DATE	BY	CK'D	APV'D

DRAWN BY	CHECKED BY	ENGINEER	DATE
R.Price			8-2-94

UNION CARBIDE CORPORATION

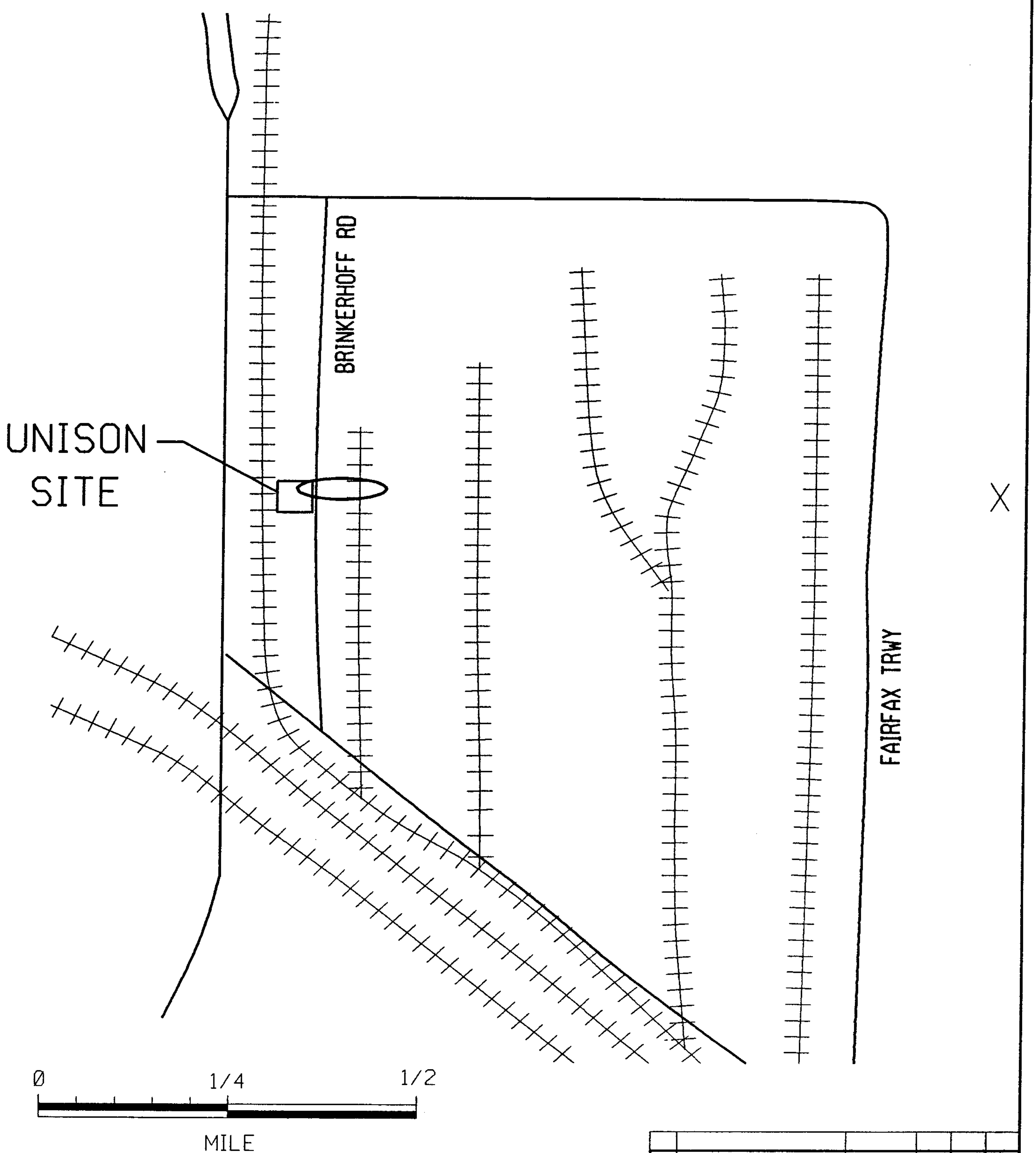
UNIT	930-	SCALE

FIGURE 7-2
MODEL RESULTS
TCE - YEAR 11 (1994)
SMALL SCALE

JOB NUMBER	UNIT SYMBOL	ZONE	AREA

FLAG(S)	CAD SAVE NAME	SIZE	REV
	AAZYL.DGN		

LOC	SITE	SUBJ	DRAWING NUMBER	SHEET



GENERAL NOTES

CONTOUR = 0.005 mg/L TCE

X = ASSUMED WELL INTAKE POINT AT GENERAL MOTORS PLANT

NO	REVISION	DATE	BY	CK'D	APV'D

DRAWN BY	CHECKED BY	ENGINEER	DATE
R.Price			8-2-94

UNION CARBIDE CORPORATION

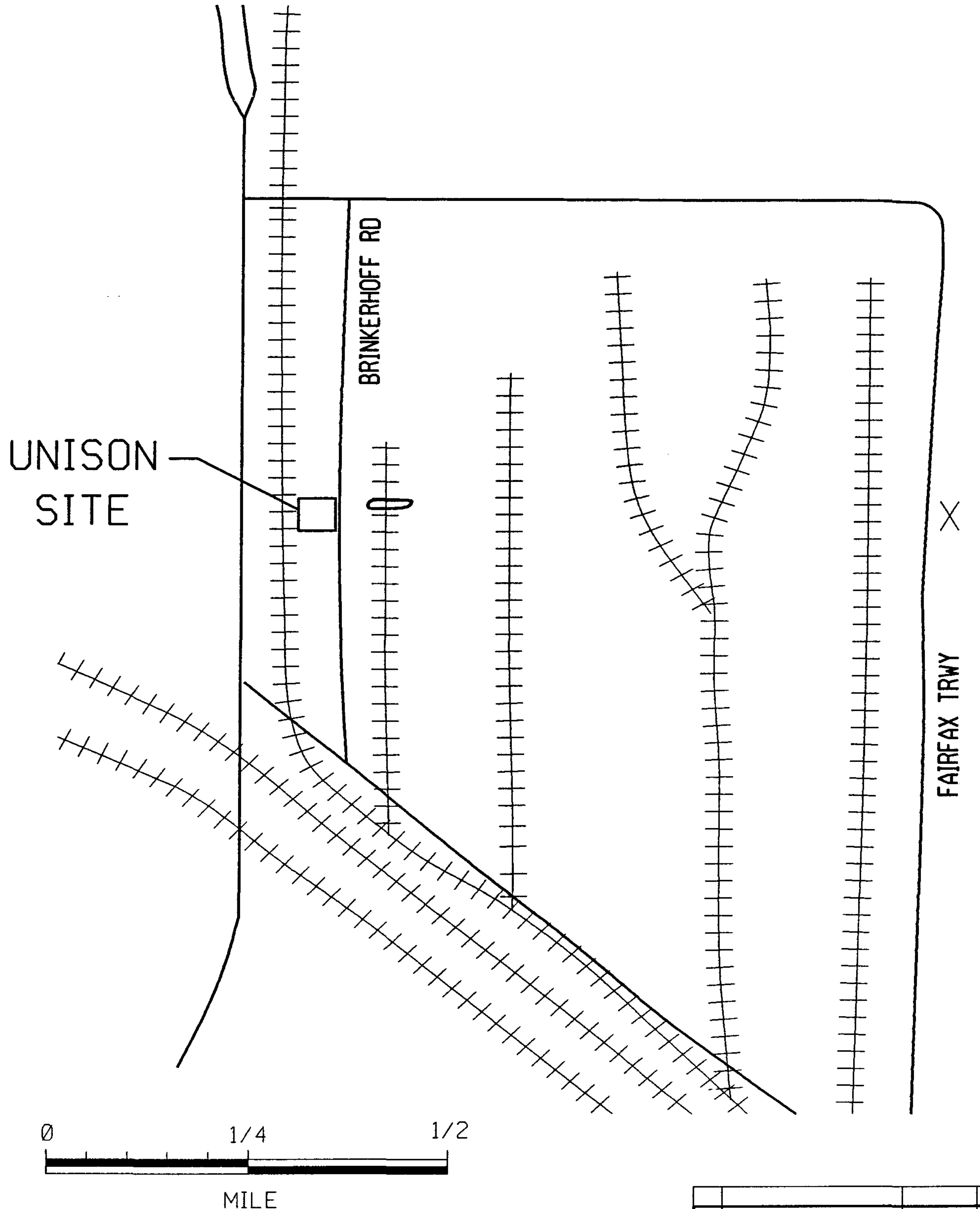
UNIT	930-	SCALE

FIGURE 7-3
MODEL RESULTS
TCE - YEAR 26 (2009)

JOB NUMBER	UNIT SYMBOL	ZONE	AREA

FLAG(S)	CAD SAVE NAME	SIZE	REV
	AAZYL.DGN		

LOC	SITE	SUBJ	DRAWING NUMBER	SHEET



GENERAL NOTES

CONTOUR = 0.005 mg/L TCE

X = ASSUMED WELL INTAKE POINT AT
GENERAL MOTORS PLANT

NO	REVISION	DATE	BY	CK'D	APV'D

DRAWN BY	CHECKED BY	ENGINEER	DATE
R.Price			8-2-94

UNION CARBIDE CORPORATION

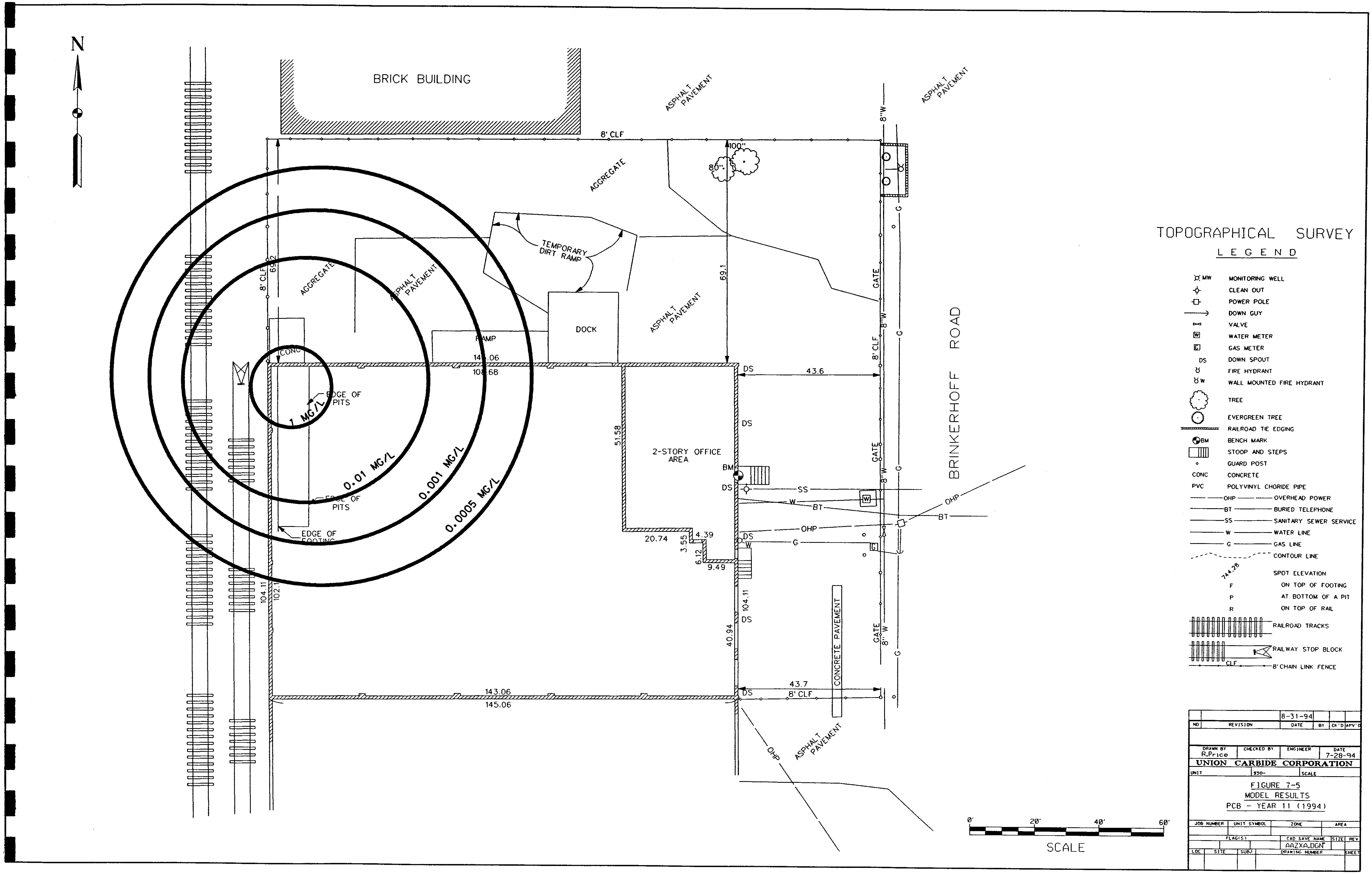
UNIT 930- SCALE

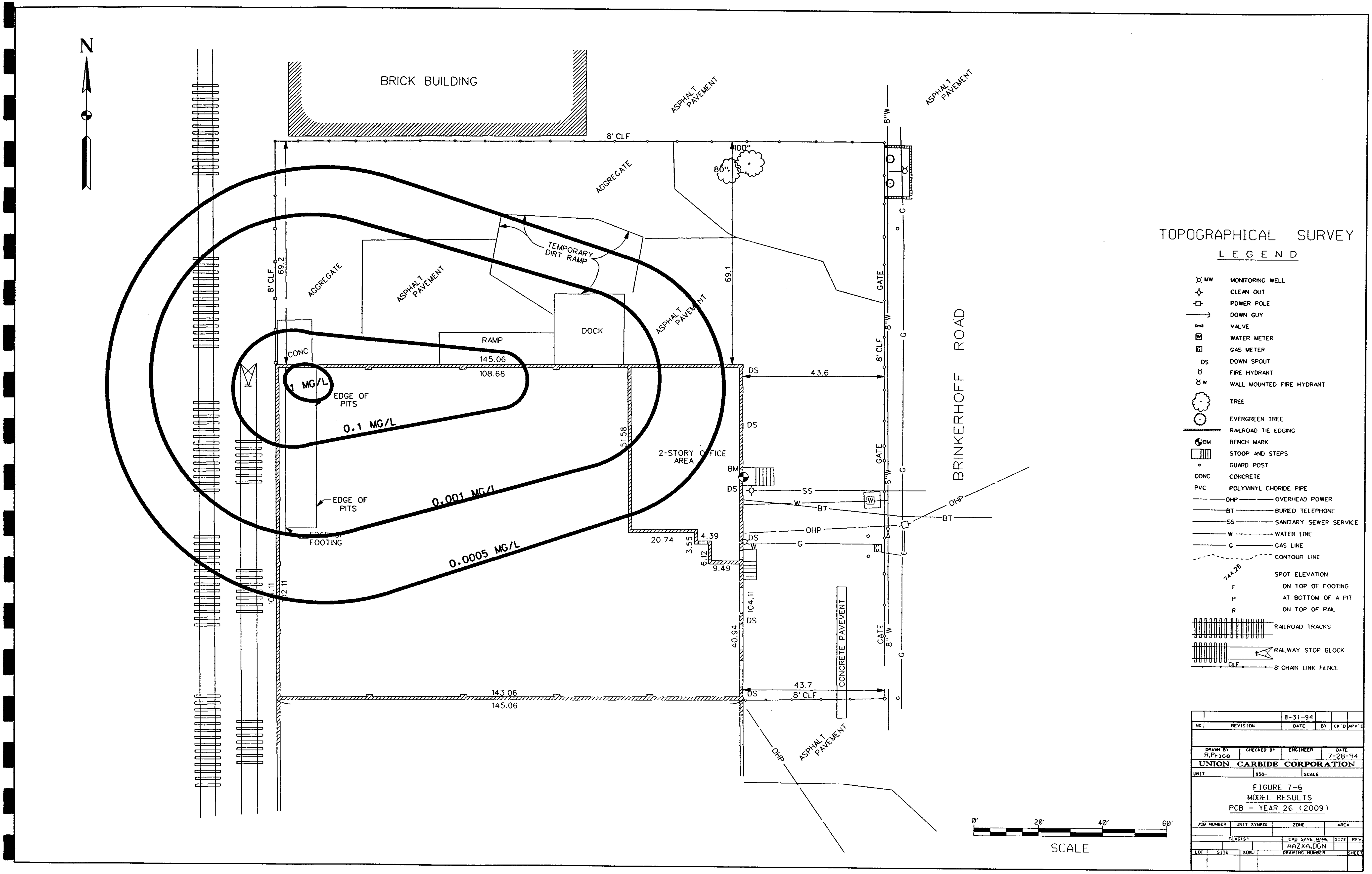
FIGURE 7-4
MODEL RESULTS
TCE - YEAR 41 (2024)

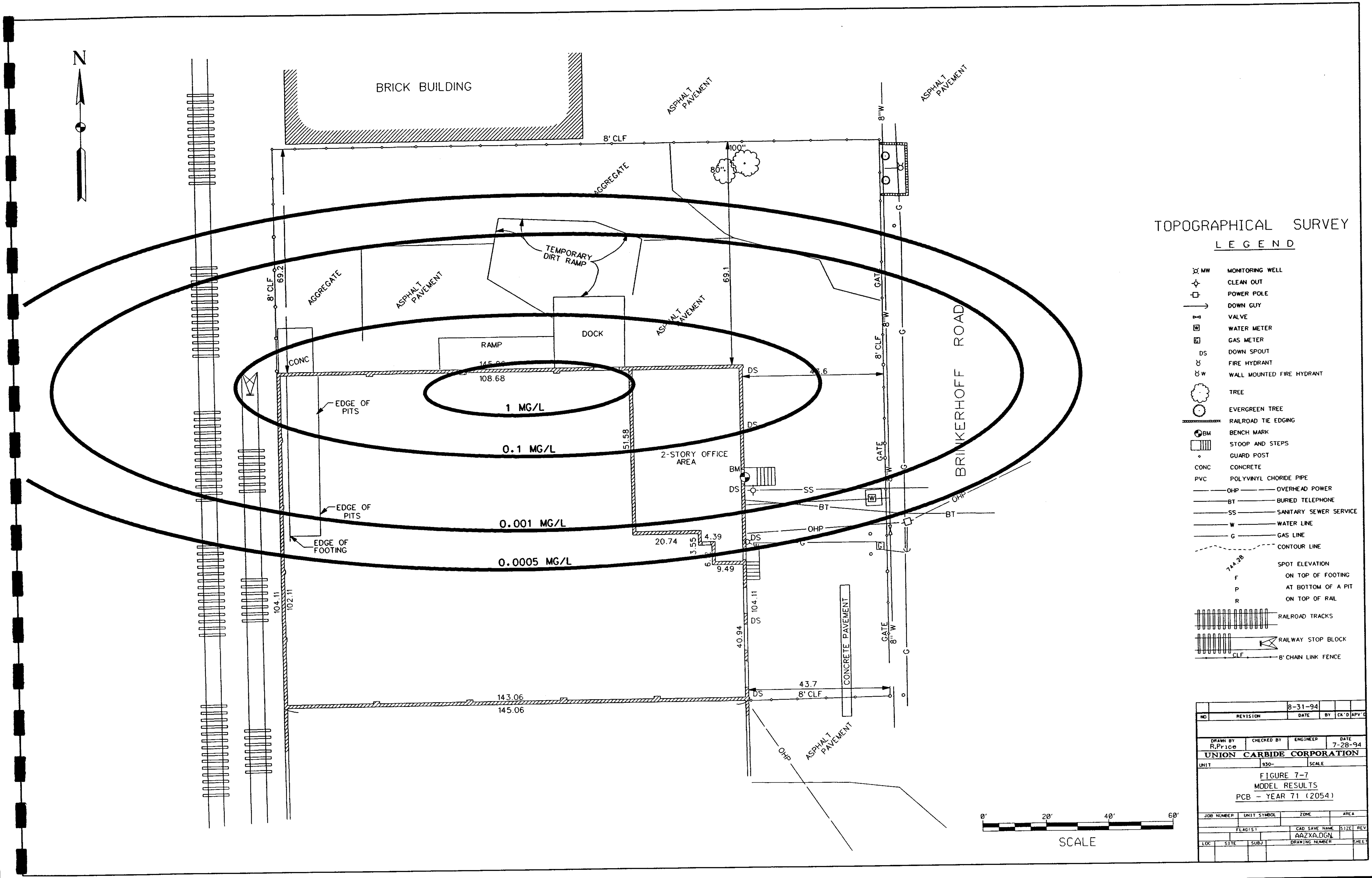
JOB NUMBER	UNIT SYMBOL	ZONE	AREA

FLAG(S) | CAD SAVE NAME: AAZYL.DGN | SIZE | REV

LOC | SITE | SUBJ | DRAWING NUMBER | SHEET


N
BRICK BUILDING
ASPHALT PAVEMENT
8' CLF
100"
80"
AGGREGATE
TEMPORARY DIRT RAMP
69.1
8' CLF
69
ASPHALT PAVEMENT
DOCK
RAMP
145.06
108.68
CONC
EDGE OF PITS
1 MG/L
0.01 MG/L
0.001 MG/L
0.0005 MG/L
EDGE OF PITS
EDGE OF FOOTING
104.11
102.1
51.58
2-STORY OFFICE AREA
BM
DS
43.6
20.74
3.55
4.39
6.12
9.49
SS
W
BT
OHP
G
104.11
40.94
CONCRETE PAVEMENT
143.06
145.06
43.7
8' CLF
GATE
8" W
BRINKERHOFF ROAD
TOPOGRAPHICAL SURVEY
LEGEND
MW MONITORING WELL
CLEAN OUT
POWER POLE
DOWN GUY
VALVE
WATER METER
GAS METER
DS DOWN SPOUT
FIRE HYDRANT
W WALL MOUNTED FIRE HYDRANT
TREE
EVERGREEN TREE
RAILROAD TIE EDGING
BM BENCH MARK
STOOP AND STEPS
GUARD POST
CONC CONCRETE
PVC POLYVINYL CHORIDE PIPE
OHP OVERHEAD POWER
BT BURIED TELEPHONE
SS SANITARY SEWER SERVICE
W WATER LINE
G GAS LINE
CONTOUR LINE
744.28 SPOT ELEVATION
F ON TOP OF FOOTING
P AT BOTTOM OF A PIT
R ON TOP OF RAIL
RAILROAD TRACKS
RAILWAY STOP BLOCK
CLF 8' CHAIN LINK FENCE
0' 20' 40' 60'
SCALE
8-31-94
NO REVISION DATE BY CK'D APV'D
DRAWN BY R.Price
CHECKED BY
ENGINEER
DATE 7-28-94
UNION CARBIDE CORPORATION
UNIT 950- SCALE
FIGURE 7-5
MODEL RESULTS
PCB - YEAR 11 (1994)
JOB NUMBER UNIT SYMBOL ZONE AREA
FLAG(S) CAD SAVE NAME SIZE REV
AAZXA.DGN
LOC SITE SUBJ DRAWING NUMBER SHEET


N
BRICK BUILDING
ASPHALT PAVEMENT
ASPHALT PAVEMENT
8' CLF
100"
80"
AGGREGATE
TEMPORARY DIRT RAMP
8' CLF
69.2
AGGREGATE
ASPHALT PAVEMENT
69.1
ASPHALT PAVEMENT
GATE
8"W
DOCK
RAMP
CONC
145.06
108.68
1 MG/L
EDGE OF PITS
0.1 MG/L
51.58
2-STORY OFFICE AREA
BM
DS
43.6
0.001 MG/L
EDGE OF PITS
EDGE OF FOOTING
0.0005 MG/L
20.74
3.55
4.39
6.12
9.49
104.11
102.11
104.11
40.94
SS
W
BT
OHP
G
CONCRETE PAVEMENT
43.7
8' CLF
143.06
145.06
ASPHALT PAVEMENT
OHP
BRINKERHOFF ROAD
TOPOGRAPHICAL SURVEY
LEGEND
MW MONITORING WELL
CLEAN OUT
POWER POLE
DOWN GUY
VALVE
W WATER METER
G GAS METER
DS DOWN SPOUT
FIRE HYDRANT
W WALL MOUNTED FIRE HYDRANT
TREE
EVERGREEN TREE
RAILROAD TIE EDGING
BM BENCH MARK
STOOP AND STEPS
GUARD POST
CONC CONCRETE
PVC POLYVINYL CHORIDE PIPE
OHP OVERHEAD POWER
BT BURIED TELEPHONE
SS SANITARY SEWER SERVICE
W WATER LINE
G GAS LINE
CONTOUR LINE
744.28 SPOT ELEVATION
F ON TOP OF FOOTING
P AT BOTTOM OF A PIT
R ON TOP OF RAIL
RAILROAD TRACKS
RAILWAY STOP BLOCK
CLF 8' CHAIN LINK FENCE
0' 20' 40' 60'
SCALE
8-31-94
NO REVISION DATE BY CK'D APV'D
DRAWN BY R.Price
CHECKED BY
ENGINEER
DATE 7-28-94
UNION CARBIDE CORPORATION
UNIT 930- SCALE
FIGURE 7-6
MODEL RESULTS
PCB - YEAR 26 (2009)
JOB NUMBER UNIT SYMBOL ZONE AREA
FLAGTS1
CAD SAVE NAME AAZXA.DGN
SIZE REV
LOC SITE SUBJ DRAWING NUMBER SHEET



N
BRICK BUILDING
ASPHALT PAVEMENT
8' CLF
AGGREGATE
TEMPORARY DIRT RAMP
RAMP
DOCK
CONC
EDGE OF PITS
EDGE OF FOOTING
2-STORY OFFICE AREA
BRINKERHOFF ROAD
CONCRETE PAVEMENT
GATE
1 MG/L
0.1 MG/L
0.001 MG/L
0.0005 MG/L
145.06
108.68
143.06
104.11
102.11
69.2
69.1
51.58
20.74
40.94
43.7
4.39
3.55
9.49
DS
BM
SS
BT
OHP
W
G
TOPOGRAPHICAL SURVEY
LEGEND
MONITORING WELL
CLEAN OUT
POWER POLE
DOWN GUY
VALVE
WATER METER
GAS METER
DOWN SPOUT
FIRE HYDRANT
WALL MOUNTED FIRE HYDRANT
TREE
EVERGREEN TREE
RAILROAD TIE EDGING
BENCH MARK
STOOP AND STEPS
GUARD POST
CONCRETE
POLYVINYL CHORIDE PIPE
OVERHEAD POWER
BURIED TELEPHONE
SANITARY SEWER SERVICE
WATER LINE
GAS LINE
CONTOUR LINE
SPOT ELEVATION
ON TOP OF FOOTING
AT BOTTOM OF A PIT
ON TOP OF RAIL
RAILROAD TRACKS
RAILWAY STOP BLOCK
8' CHAIN LINK FENCE
0' 20' 40' 60'
SCALE
8-31-94
REVISION DATE BY CK'D APV'D
DRAWN BY R.Price
DATE 7-28-94
UNION CARBIDE CORPORATION
FIGURE 7-7
MODEL RESULTS
PCB - YEAR 71 (2054)
AAZXA.DGN

APPENDIX A

BOWDEN
CONTRACTING COMPANY, INC.
1030 PAWNEE AVENUE
KANSAS CITY, KANSAS 66105
913-342-5112
FAX 913-342-5148

RCVD 3/15/94

March 14, 1994

Mr. Eric Radke
Westinghouse Remediation Services, Inc.
21750 Cedar Avenue
P.O. Box 550
Lakevillle, MN 55044

RE: Unison Project
3126 Brinkerhoff Road
Kansas City, Kansas

Dear Mr. Radke,

On Friday, March 11, 1994, Ken Blom of Kenneth M. Blom & Associates (structural engineer) and I, met with Roy Leonard of Alpha-Omega GeoTech, Inc. (soils engineer) at Roy's office to discuss the current situation at the referenced site and the possibilities of excavating deeper as you requested.

Roy had received a packet of information of the helical underpinning on March 7, 1994 to allow him time to review the method Ken was proposing to use. When Ken and I presented to Roy our ideas of what we were proposing to do, Roy had grave concerns of the current situation. Roy had concerns about any additional excavating occurring and commented that we were "treading on thin ice as it stands right now". Roys concerns are as follows:

1. Bearing failure of footings occurring due to the saturated sand getting wetter due to rising water table or surface water migration. There is a high possibility in the present state, excavated 13 feet below bottom of footing that the wet sands will flow and result in voids in all directions.

2. Basal failure of the interior column foundations due to the saturated sands, these could be undermined easily.

3. This is the time of year where historically we have the greatest chance of rains. According to Mark Liggett of Unison, the water table has risen approximately eight inches in the last week.

Mr. Eric Radke
March 14, 1994
Page 2

4. If the three (3) cells are maintained open, immediately he would recommend a dewatering strategy.

5. For us to make any recommendations due to the seriousness of the existing conditions, a couple of things need to happen.

   A. Soils investigation to determine soils bearing and soils makeup to allow for proper structural recommendations.

   B. Dewatering of the surrounding area to a depth that would allow for the soils to dry out and stabilize.

As it stands right now, in light of my last meeting with Ken Blom and Roy Leonard, I feel that we need to set up a meeting with you, a Unison representative, Ken and Roy and determine immediately what direction we go. Or we need to fill and compact the open cells with the clean dirt on site to head off any potential problems.

USE PLASTIC O'
S: 3000 # B = 7700

Please let me know what direction you want to take. I anxiously await your response.

Sincerely,
Bowden Contracting Company, Inc.

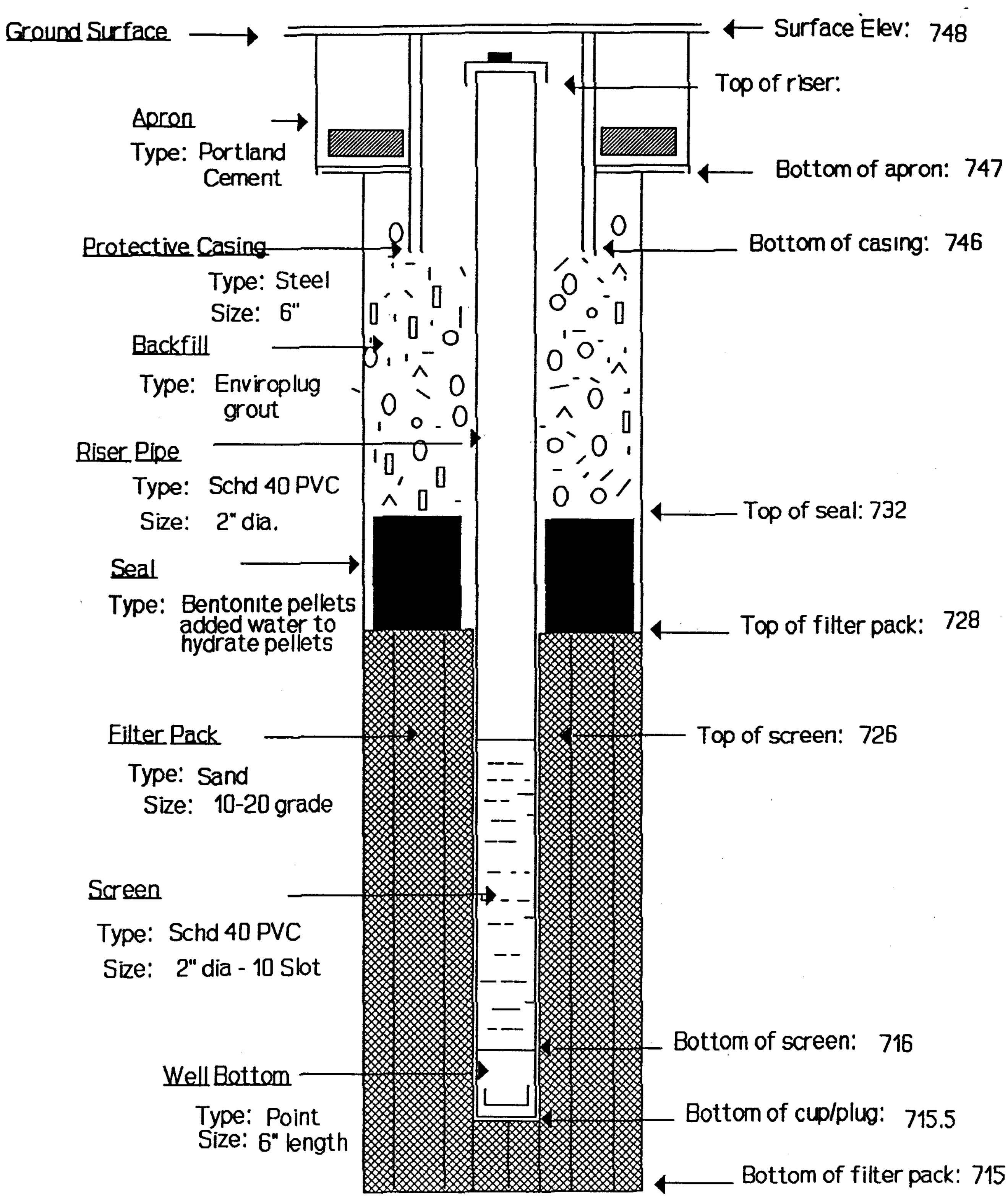
Dan Bowden
President

3/15/94
Per Discussion with Eric Radke, Agreed to Replace (PAF) and Compact 3 Feet of Clean Fill in Each of Three Open Cells.

DB:kmb
ltr/3

APPENDIX B

MONITORING WELL INSTALLATION FORM



Project Number: K41001.0 Project Name: Unison Date Completed: 4/21/94 Installed by: Layne-Western	Well Number: PZ-3 ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project: Unison Owner: Union Carbide Corp.

Location: Kansas City, KS W.O. Number: K41001.0

Number: PZ-3 Total Depth: 33ft. Diameter: 8" OD

Surface Elevation: 748 msl Water Level: Init ___ 24hrs ___

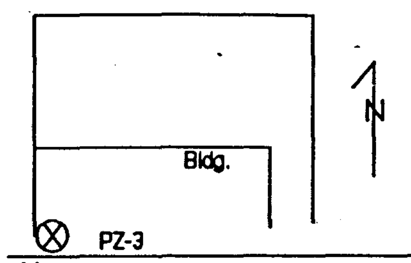
Screen: Dia 2" Length 10 ft. Slot Size 0.010"

Casing: Dia 2" Length 22" Type Schd 40 PVC

Drilling Company: Layne Western Drilling Method: HSA

Driller: O.J. Harper Log By: MM Katzman Date: 4/21/94

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0				Concrete, gravel subgrade FILL. Boring advanced with 4 1/4" ID (8" OD) HSA. Mobile B31 mounted on Ford farm tractor.
1				Very stiff, brown Silty Clay FILL with gravel. (FILL)
2				
3				
4				Motthed Clay Silt to Silty Clay FILL light and dark brown. (FILL)
5				
6				
7				Predominantly Silty FILL. (FILL)
8				
9				
10				
11				
12				
13				

Environmental Resources Management

Drilling Log

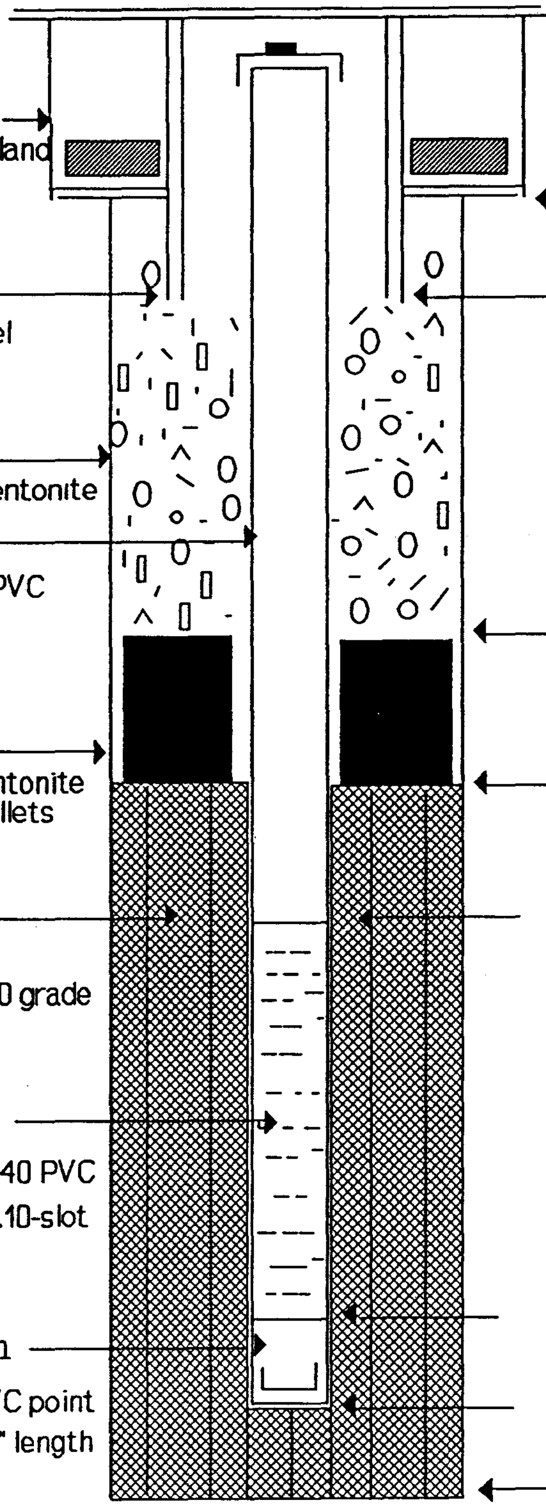
Number PZ-3

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
13				SAME: Clayey Silty FILL. (FILL)
14				Soft Clayey SILT, wet saturated, gray-brown. Mottled light to dark. (ML)
15				
16				
17				
18				Less mottling.
19				Fine-very fine SAND, silt content decreasing. (SM)
20				
21				
22				Fine-medium SAND. (SP)
23				
24				Very damp and wet.
25				Brown, loose Silty SAND. (SM) Easy drilling advance.
26				
27				
28				Medium grained, poorly graded SAND with fine sand. (SP)
29				
30				

Number PZ-3

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30				SAME: Medium grained poorly graded SAND with fine SAND. (SP) Harder drilling.
31				
32				Very fine grained Silty SAND mixed with Sandy SILT. (SM)
33				Bottom of Boring 33 ft.

MONITORING WELL INSTALLATION FORM



Ground surface

Surface Elev: 744

Top of riser

Apron
Type: Portland cement

Bottom of apron: 743

Protective Casing
Type: Steel
Size: 6"

Bottom of casing: 742

Backfill
Type: Cement grout with bentonite

Riser Pipe
Type: Schd 40 PVC
Size: 2" dia.

Top of seal: 729

Seal
Type: Bentonite pellets

Top of filter pack: 725

Filter Pack
Type: Sand
Size: 10-20 grade

Top of screen: 721.8

Screen
Type: Schd 40 PVC
Size: 2" dia. 10-slot

Bottom of screen: 711.8

Well Bottom
Type: PVC point
Size: 6" length

Bottom of cup/plug: 711.3

Bottom of filter pack: 711

Project Number: K41001
Project Name: Unison
Date Completed: 4/22/94
Installed by: Layne-Western

Well Number: PZ4 A

ERM Rocky Mountain, Inc.
9300 W. 110th Street, Suite 490
Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project Unison Owner Union Carbide Corp.

Location Kansas City, KS W.O. Number K41001.0

Number PZ4 Total Depth 32' Diameter 8" OD

Surface Elevation 744' Water Level: Init --- 24 hrs ---

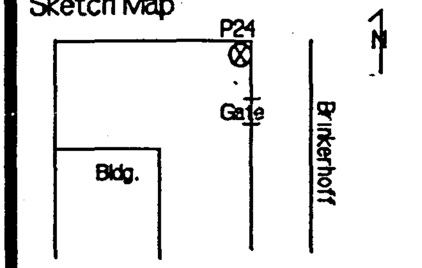
Screen: Dia 2" Length 10' Slot Size 10

Casing: Dia 2" Length 20' Type Schd 40 PVC

Drilling Company Layne Western Drilling Method HSA

Driller O.J. Harper Log By MM Katzman Date 4/21/94

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0				Gravel Sand FILL — Boring advanced w/ 4-1/4" ID HSA (8" OD), w/ Mobile B 31 on Ford farm tractor, used teflon knock-out plug.
1				Very fine grained Silty SAND, brown to Sandy SILT low plastic saturated. (SM-ML)
2				
3				Becoming very fine Silty SAND brown, moist. (SM)
4				
5				
6				
7				
8				Becoming damp to wet with some free water. (SM)
9				
10				
11				
12				
13				

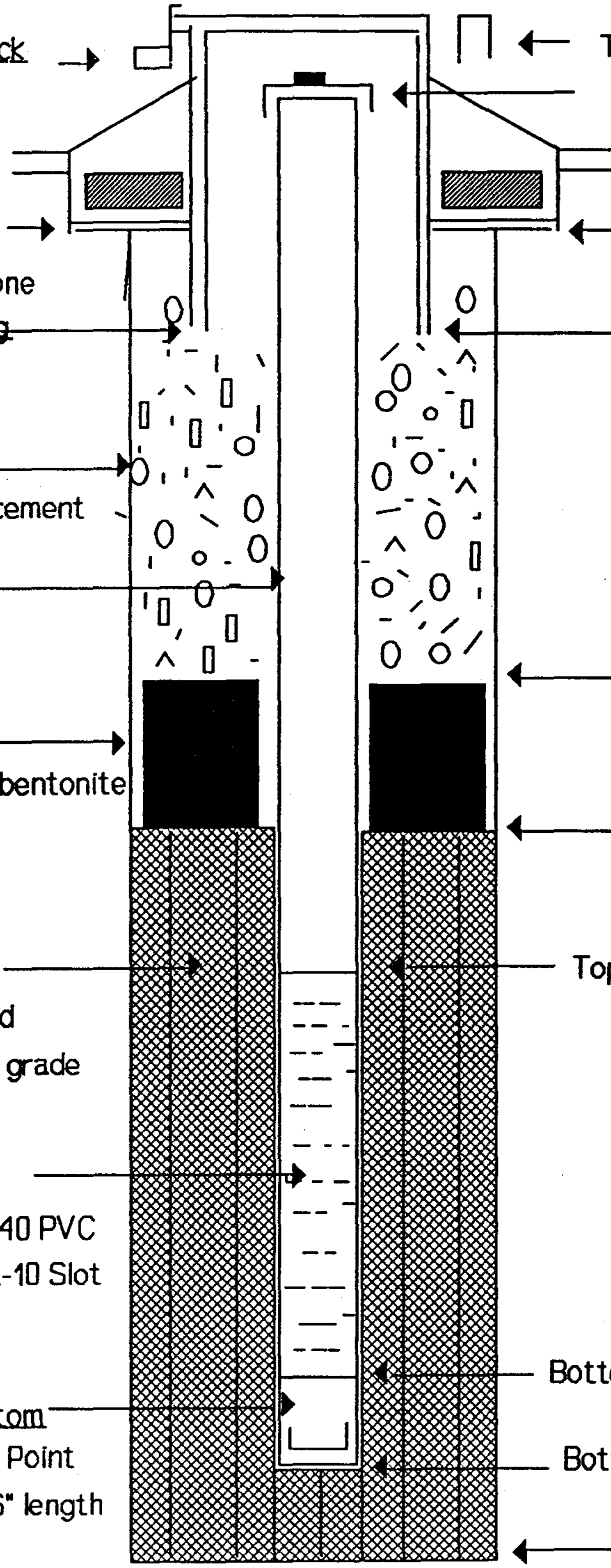
Number: PZ4

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
13				SAME: Brown, very fine grained Silty SAND, damp to wet.	(SM)
14					
15					
16					
17				Becoming mixed very fine Silty SAND and fine SAND w/ same Sandy Zones.	(SM w/ SP)
18					
19					
20				Brown, fine grained, poorly graded SAND w/ same medium sand	(SP)
21					
22					
23					
24				w/ much medium sand.	
25				Medium grained, poorly graded sand.	(SP)
26					
27					
28					
29					
30				Very Silty SAND.	(SM)

Number PZ4

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30				SAME: Very Silty SAND (SM)
31				
32				Bottom of Boring 32 ft.
33				

MONITORING WELL INSTALLATION FORM



Lock

Top of casing: None

Top of riser: 742.7

Ground Surface

Surface Elev: 740 ±

Apron
Type: None

Bottom of apron: None

Protective Casing
Type: None
Size: None

Bottom of casing: None

Backfill
Type: bentonite/cement grout

Riser Pipe
Type: Schd 40 PVC
Size: 2" dia..

Top of seal: 730

Seal
Type: Holeplug - bentonite chips

Top of filter pack: 728

Filter Pack
Type: Sand
Size: 10-20 grade

Top of screen: 725

Screen
Type: Schd 40 PVC
Size: 2" dia-10 Slot

Bottom of screen: 715

Well Bottom
Type: Point
Size: 6" length

Bottom of cup/plug: 714.5

Bottom of filter pack: 712

Project Number: K41001.0	Well Number: MW11A
Project Name: Unison	ERM Rocky Mountain, Inc.
Date Completed: 5/5/94	9300 W. 110th Street, Suite 490
Installed by: Layne-Western	Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project: Unison — Owner: Union Carbide Corp.

Location: Kansas City, KS — W.O. Number: K41001.0

Well Number: MW11A — Total Depth: 28 — Diameter: 8" OD

Surface Elevation: 741 msl — Water Level: Init: --- 24 hrs: ---

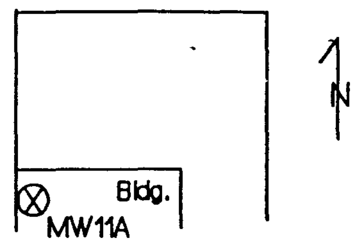
Screen: Dia: 2" — Length: 10 ft. — Slot Size: 10

Casing: Dia: 2" — Length: 18 ft. — Type: Schd 40 PVC

Drilling Company: Layne Western — Drilling Method: HSA

Driller: O.J. Harper — Log By: MM Katzman — Date: 5/5/94

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0				FILL Dense, low plastic Silty clay to Clayey Silt FILL. (FILL) Boring advanced with 8" OD-4 1/4" ID HSA with truck mounted Acker 82
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				With OCC gravel sized rock fragments. (FILL)
11				
12				
13				

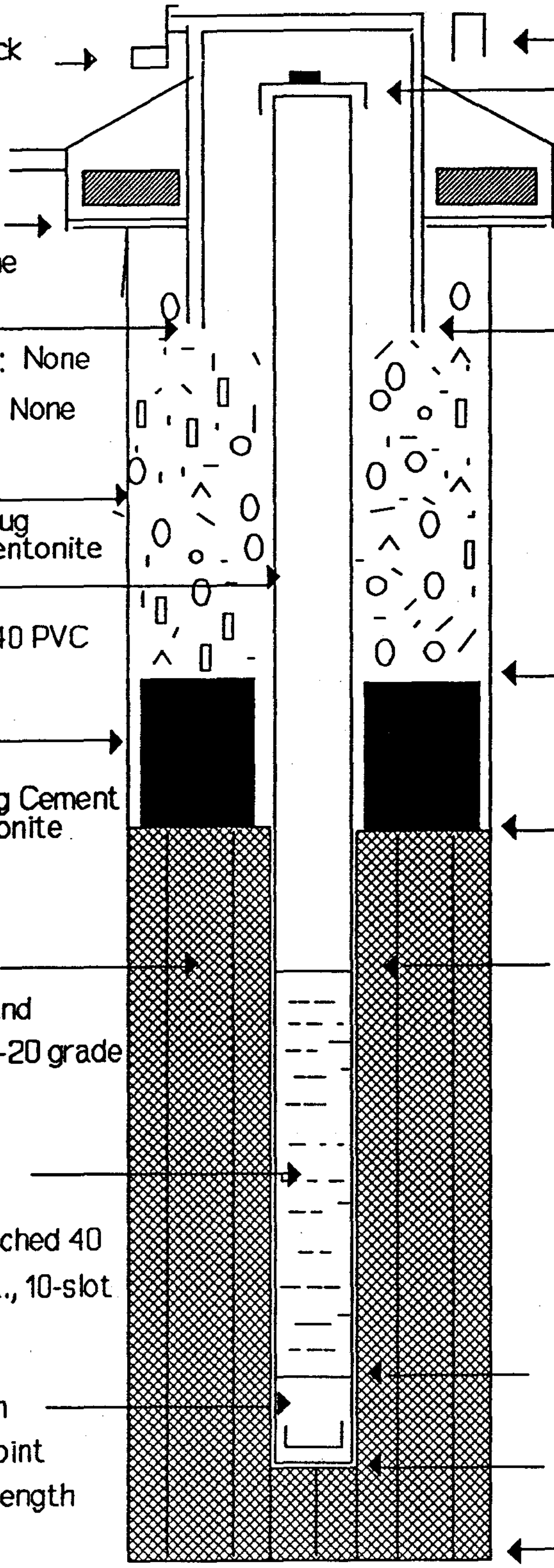
Environmental Resources Management

Drilling Log

Number MW11A

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
13				SAME: FILL.	(FILL)
				Very fine, low damp-moist, plastic Clayey-Sandy SILT.	(ML)
14					
15				Very fine grained Silty SAND saturated.	(SM)
16					
17					
18					
19					
20				Becoming fine with some SILT.	(SM-SP)
21				Dark brown, medium, poorly graded SAND.	(SP)
22					
23				Fine-medium, poorly graded SAND	(SP)
24					
25					
26				Light brown, very fine Silty SAND.	(SM)
27					
28				Bottom of Boring 28ft.	
29					
30					

MONITORING WELL INSTALLATION FORM



Lock

Ground Surface

Apron
Type: None

Protective Casing
Type: None
Size: None

Backfill
Type: Enviroplug cement and bentonite

Riser Pipe
Type: Schd 40 PVC
Size: 2" dia.

Seal
Type: Enviroplug Cement and bentonite

Filter Pack
Type: Sand
Size: 10-20 grade

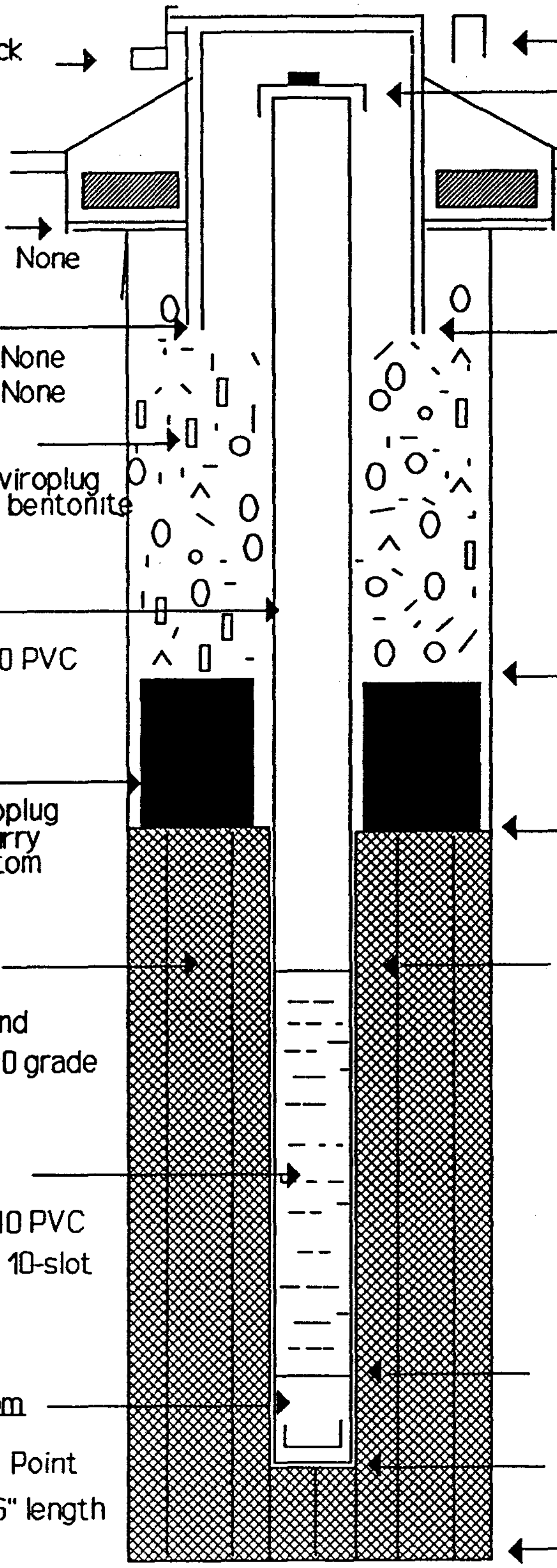
Screen
Type: PVC Sched 40
Size: 2" dia., 10-slot

Well Bottom
Type: Point
Size: 6"length

Top of casing None
Top of riser 746.9
Surface Elev: 744
Top of grout elev.: 744
Bottom of apron: None
Bottom of casing: None
Top of seal: 729
Top of filter pack: 726
Top of screen: 724
Bottom of screen: 714
Bottom of cup/plug: 713.5
Bottom of filter pack: 711

Project Number: K41001.0 Project Name: Unison Date Completed: 5/4/94 Installed by: Layne-Western	Well Number: MW12A ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

MONITORING WELL INSTALLATION FORM



Lock

Top of casing: None

Top of riser: 745.3

Ground Surface

Surface Elev: 744

Top of grout elev.: 744

Apron
Type: None

Bottom of apron: None

Protective Casing
Type: None
Size: None

Bottom of casing: None

Backfill
Type: Enviroplug cement, bentonite grout

Riser Pipe
Type: Schd 40 PVC
Size: 2" dia.

Top of seal: 729

Seal
Type: Enviroplug bentonite slurry Tremied bottom

Top of filter pack: 708

Filter Pack
Type: Sand
Size: 10-20 grade

Top of screen: 705

Screen
Type: Schd 40 PVC
Size: 2" dia., 10-slot

Bottom of screen: 695

Well Bottom
Type: Point
Size: 6" length

Bottom of cup/plug: 694.5

Bottom of filter pack: 690

Project Number: K41001.0	Well Number: MW12B
Project Name: Unison Date Completed: 5/4/94 Installed by: Layne-Western	ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project Unison Owner Union Carbide Corp.

Location Kansas City, KS W.O. Number K41001.0

Number MW12B Total Depth 54' Diameter 8" OD

Surface Elevation 744.5 msl Water Level: Init -- 24 hrs --

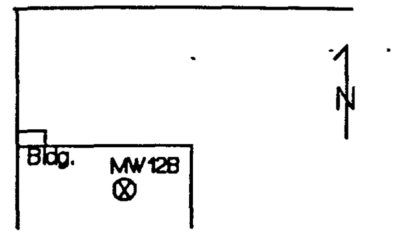
Screen: Dia 2" Length 10' Slot Size 10

Casing: Dia 2" Length 40' Type Schd 40 PV

Drilling Company Layne Western Drilling Method HSA

Driller O.J. Harper Log By MM Katzman Date 5/4/94

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0				FILL. Boring advanced by 8" OD HSA w/ truck mounted Acker 82.
1				
2				Light brown-tan, dry, very fine Clayey SILT. (ML)
3				
4				Becoming damp.
5				
6				Mixed low plastic, Silty CLAY and slightly sandy, Clayey SILT. (CC & ML)
7				Low plastic, Silty CLAY, damp dark brown. (CL)
8				Low plastic, brown Clayey SILT. (ML)
9				
10				
11				
12				
13				

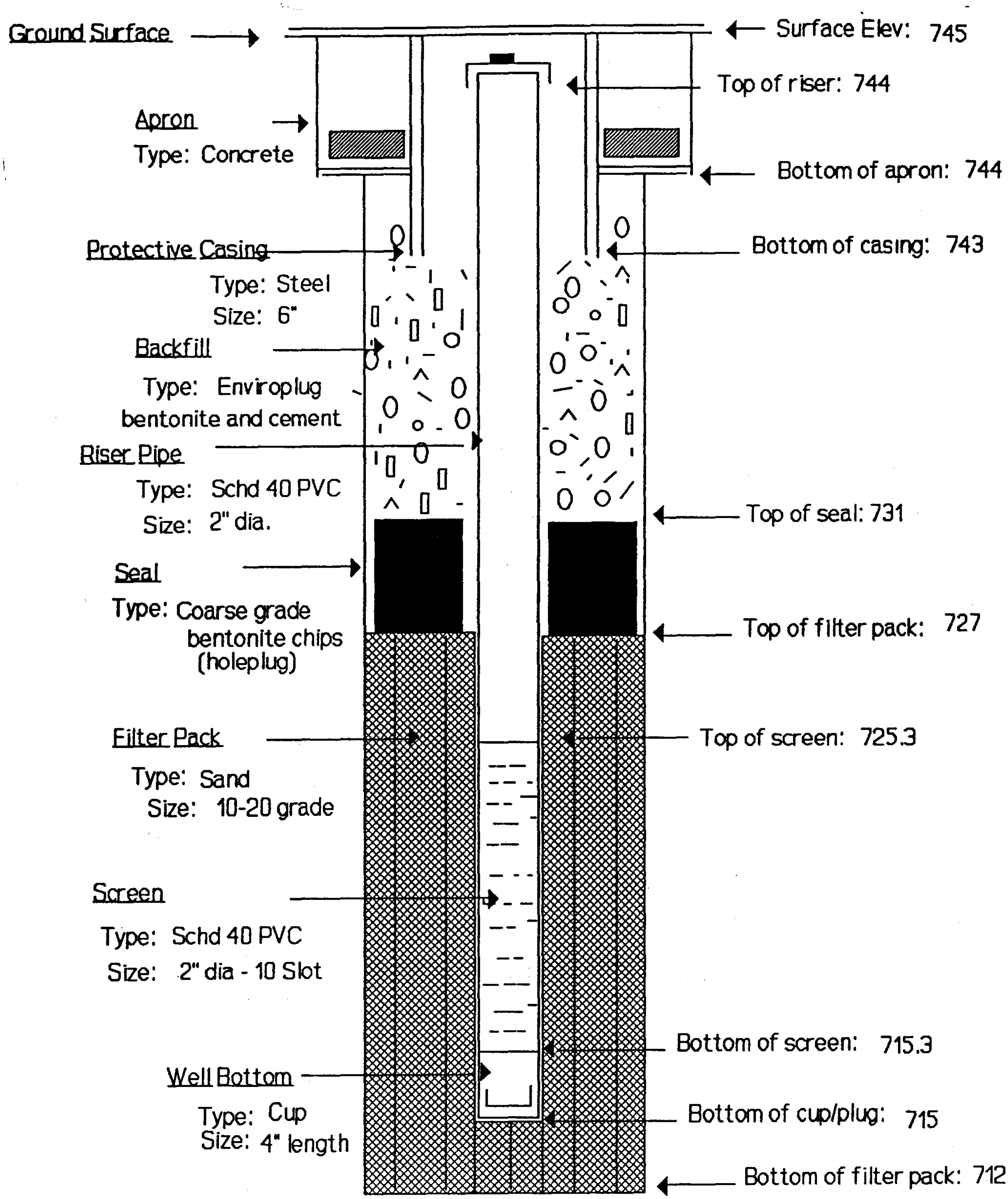
Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
13				SAME: Light brown, low plastic, Clayey SILT. (ML)
14				
15				Light brown, very fine Silty SAND to Sandy SILT (SM)
16				
17				with dicrete zones/strata of low plastic Clayey SILT (ML)
18				moist to damp.
19				
20				Becoming Sandy SILT to Silty SAND. (SM)
21				
22				
23				
24				
25				Very fine grained Silty SAND with tr. medium sand. (SM)
26				SAME: very fine grained Silty SAND with tr. medium sand. (SM)
27				
28				
29				
30				

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30				
31				Becoming fine SAND with some SILT. (SP w/SM)
32				
33				
34				
35				Fine SAND with tr. of medium SAND with some very fine Silty SAND. (SP w/SM)
36				
37				
38				
39				SAME: Fine SAND with tr. of medium SAND with some very fine Silty SAND. (SP w/ SM)
40				
41				
42				Fine to medium SAND with tr. coarse SAND. (SP)
43				
44				
45				
46				
47				

Number: MW12B

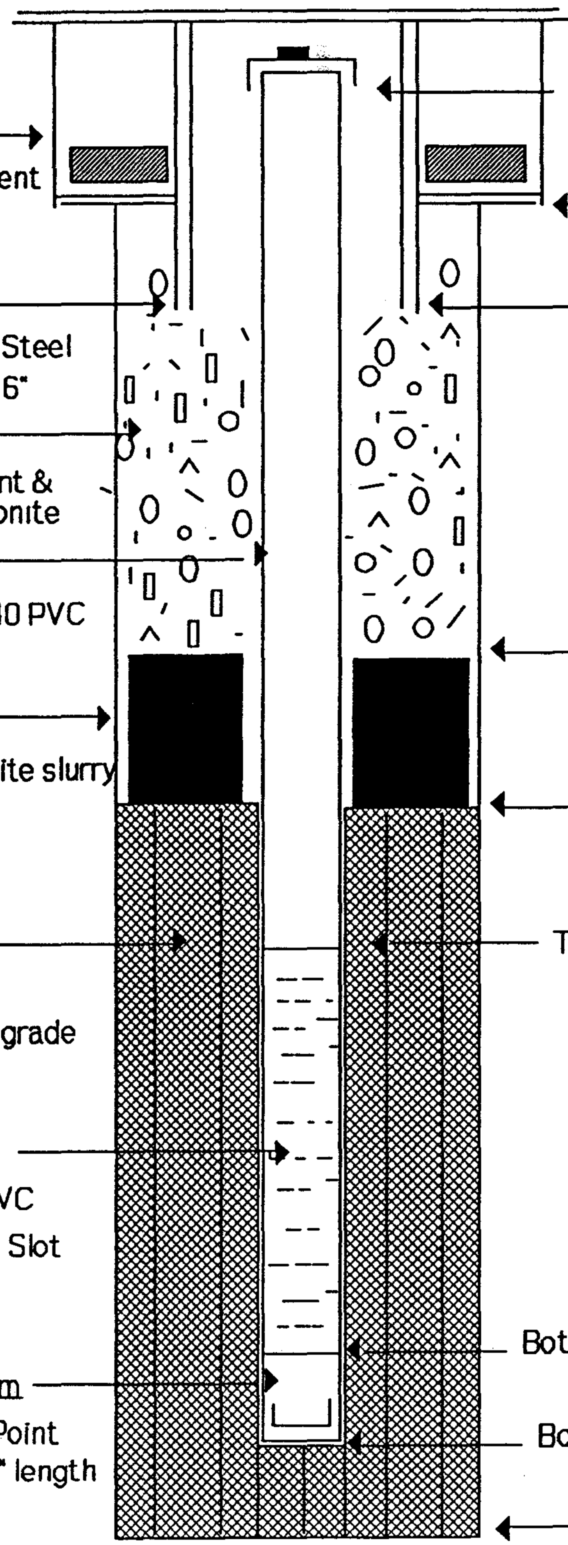
Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
47				Same: Fine to medium SAND with tr. of coarse SAND. (SP)
48				Medium poorly graded SAND w/ some fine and tr. of coarse sand with some lignite. (SP)
49				
50				Becoming coarse with some medium SAND with tr. of fine to medium gravel. (SP)
51				
52				
53				Becoming fine to medium with some Silty SAND and CLAY GULLS. (SP w/ SM)
54				Bottom of Boring 54ft.

MONITORING WELL INSTALLATION FORM



Project Number: K41001.0 Project Name: Unison Date Completed: 5/3/94 Installed by: Layne-Western	Well Number: MW13A ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

MONITORING WELL INSTALLATION FORM



Project Number: K41001.0 Project Name: Unison Date Completed: 5/3/94 Installed by: Layne-Western	Well Number: MW13B ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project: Unison Owner: Union Carbide Corp.

Location: Kansas City, KS W.O. Number: K41001.0

Number: MW13B Total Depth: 54 ft. Diameter: 8" OD

Surface Elevation: 745 msl Water Level: Init: – 24 hrs: –

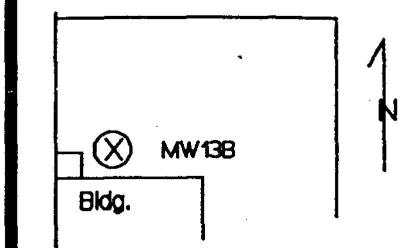
Screen: Dia: 2 inches Length: 10 ft. Slot Size: 10

Casing: Dia: 2 inches Length: 40 ft. Type: Schd 40 PVC

Drilling Company: Layne Western Drilling Method: HSA

Driller: O.J. Harper Log By: Mike Katzman Date: 5/3/94

Sketch Map



Notes

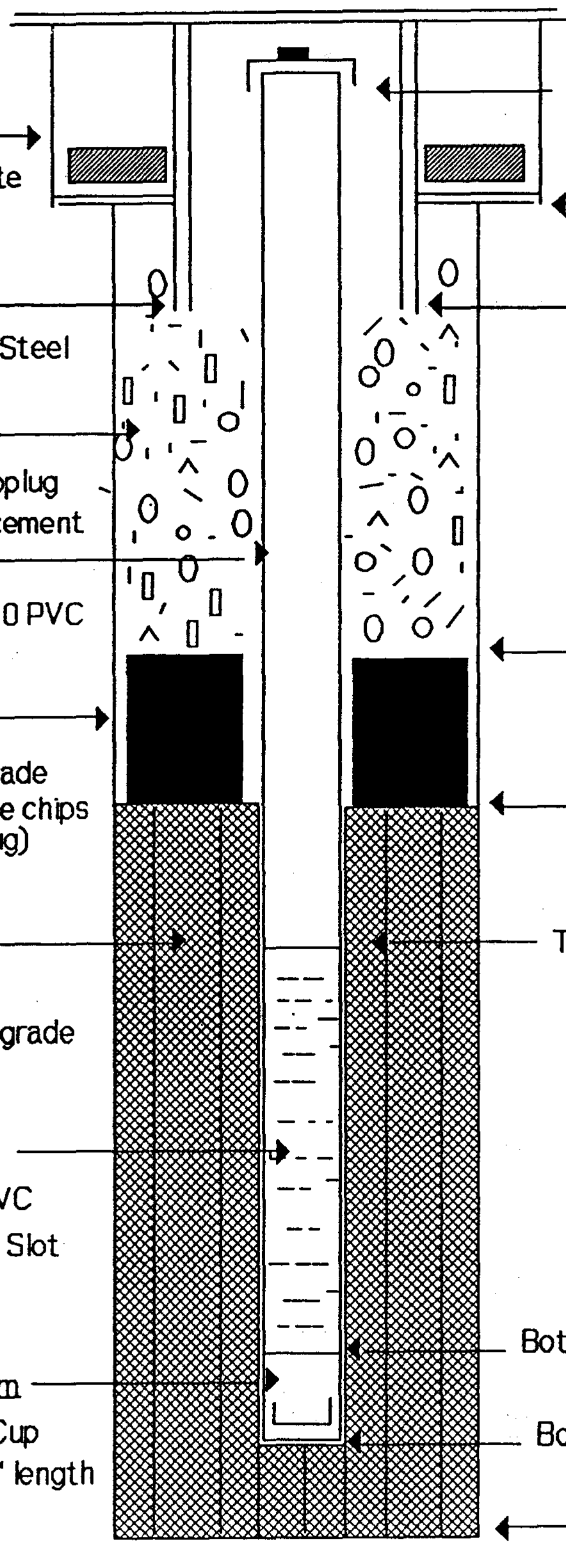
Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
0				FILL	Boring advanced with 4 1/4" ID HSA and Acker B2 truck mounted rig
1				Dark brown, Clayey SILT - damp to wet.	(ML)
2					
3					
4				Mixed low plastic Silty CLAY and Clayey SILT.	(ML & CL)
5					
6					
7					
8					
9					
10				Light brown very fine Silty SAND.	(SM)
11					
12				Mixed with layers of Sandy SILT.	(SM w/ ML)
13					

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
13				Same: Light brown, very fine Silty SAND with Sandy SILT.	(SM w/ ML)
14					
15				Light brown, very fine grained Silty SAND; moist.	(SM)
16					
17					
18				Mixed very fine Silty SAND with layers of Sandy SILT.	(SM w/ ML)
19				Fine SAND; wet.	(SP)
20					
21				Fine, medium SAND with tr. of Silty SAND.	(SP w/ SM)
22					
23					
24					
25					
26					
27					
28					
29				Medium grained with some fine SAND with tr. of lignite.	(SP)
30					

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30				Same: Medium grained with some fine SAND with tr. of lignite. (SP)
31				
32				
33				Elevated PID readings: Suited up to Level C.
34				
35				
36				Medium to coarse SAND with lignite; poorly graded.
37				
38				
39				
40				
41				
42				Becoming medium, fine grained.
43				Silty SAND. (SM)
44				
45				No recovery.
46				
47				

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
47				Same: No recovery.	
48					
49				Medium, coarse grained SAND.	(SP)
50				Becoming medium grained SAND.	
51					Running sands.
52				Becoming coarse grained SAND.	
				Medium to very fine Silty SAND; poorly graded.	(SP-SM)
53					
54				Medium to very fine SAND.	(SM)
55					Bottom of Boring 54'.

MONITORING WELL INSTALLATION FORM



Ground Surface

Surface Elev: 745

Top of riser: 744.9

Apron
Type: Concrete

Bottom of apron: 744

Protective Casing
Type: Steel
Size:

Bottom of casing: 743

Backfill
Type: Enviroplug bentonite and cement

Riser Pipe
Type: Schd 40 PVC
Size: 2" dia.

Top of seal: 728.5

Seal
Type: Coarse grade bentonite chips (holeplug)

Top of filter pack: 726.5

Filter Pack
Type: Sand
Size: 10-20 grade

Top of screen: 725

Screen
Type: Schd 40 PVC
Size: 2" dia - 10 Slot

Bottom of screen: 715

Well Bottom
Type: Cup
Size: 4" length

Bottom of cup/plug: 714.5

Bottom of filter pack: 712.5

Project Number: K41001.0 Project Name: Unison Date Completed: 5/2/94 Installed by: Layne-Western	Well Number: MW14A ERM Rocky Mountain, Inc. 9300 W. 110th Street, Suite 490 Overland Park, Kansas 66210

Environmental Resources Management

Drilling Log

Project: Unison — Owner: Union Carbide Corp.

Location: Kansas City, KS — W.O. Number: K41001.0

Number: MW14A — Total Depth: 32ft. — Diameter: 8" OD

Surface Elevation: 745msl — Water Level: Init: -- — 24 hrs: --

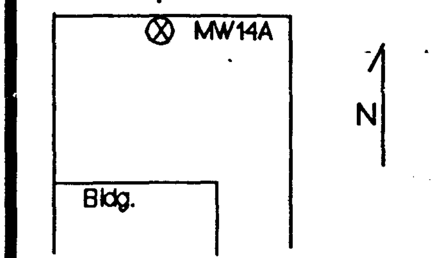
Screen: Dia: 2" — Length: 10 ft. — Slot Size: 10

Casing: Dia: 2" — Length: 20 ft. — Type: Schd 40 PVC

Drilling Company: Layne Western — Drilling Method: HSA

Driller: O.J. Harper — Log By: MM Katzman — Date: 5/2/94

Sketch Map



Notes

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)	
0				FILL. (FILL)	Boring advanced with 4-1/4" HSA on truck mounted Acker 82 rig.
				Low plastic, dark brown Silty CLAY. (CL)	
1					
2				Low plastic, moist, tan Clayey SILT. (ML)	
3					
4					
5				Becoming medium brown.	
6					
7					
8				Becoming damp.	
9					
10					
11				Becoming very fine, Silty SAND to Sandy SILT. (SM)	
12					
13					

Number MW14A

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
13				SAME: Medium brown, moist, very fine grained Silty SAND with Sandy SILT. (SM)
14				
15				
16				With mixed Sandy SILT and Clayey SILT. (SM w/ ML)
17				
18				Becoming wet and light medium brown.
19				
				With much fine SAND.
20				
				No return.
21				Medium grained SAND. (SP)
22				
23				
24				
25				Medium fine, light brown SAND with Silt. (SP)
26				
27				Free water.
28				Fine to medium, light brown SAND.
29				
30				

Number MW14A

Depth (Feet)	Graphic Log	Well Construction	Sample Number	Description/Soil Classification (Color, Texture, Structures)
30				SAME: Medium, light brown SAND. Medium with same fine SAND with tr. of silt and lignite.
31				
32				Very fine Silty SAND with Sandy SILT. (SM w/ ML) Bottom of Boring 32 ft.
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				
47				

Environmental Resources Management

Drilling Log

Project: Unison — Owner: Union Carbide Corp.

Location: Kansas City, KS — W.O. Number: K41001.0

Number: S-1 — Total Depth: 60 ft. — Diameter: 3-7/8" - 4"

Surface Elevation: 745 msl — Water Level: Init: N/A — 24hrs: N/A

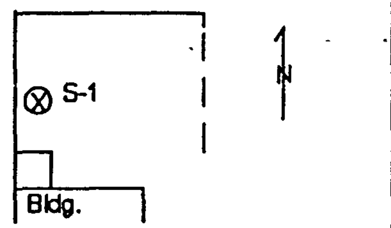
Screen: Dia: N/A — Length: N/A — Slot Size: N/A

Casing: Dia: N/A — Length: N/A — Type: N/A

Drilling Company: Layne Western — Drilling Method: Rotary Mud

Driller: O.J. Harper — Log By: MM Katzman — Date: 4/20/94

Sketch Map



Notes

Depth (Feet)	Recovery	SPT	Sample Number	Description/Soil Classification (Color, Texture, Structures)
0–2				Gravel and clay-silt BACKFILL. Boring advanced with 3-7/8" fishtail-drag bit, rotary method and bentonite slurry. Gardner Denver Rig. Samples obtained with 2" diameter split spoon
2–4	13/24	5, 5, 2, 5	S11	Firm, dark brown, low plastic, Clayey SILT with tr. fine sand (ML). Becoming firm to base of silt
4–6	21/24	3, 4, 6, 8	S12	Firm to stiff dense, brown low plastic Silty CLAY with fine sand and some clayey silt with red brown mottling. (CL). With Clayey SILT lenses (W/ML)
6–8	15/24	2, 3, 2, 2	S13	Becoming firm and very thinly bedded to laminated with decreasing silt lenses. Clay is mottled red-brown. (CL)
8–10	23/24	2, 1, 2, 4	S14	Very loose, thin bedded mottled gray and brown, low plastic Clayey SILT (ML) and thin CLAY lenses with fine sand. Approximately 30% DWL between 8 and 10 ft.
10–12	24/24	2, 2, 3, 4	S15	With sand lens at 11 ft. Becoming loose, thin bedded laminated gray and brown Clayey SILT. (ML)
12–13	24/24	4, 4, 6, 9	S16	Medium dense thin bedded, gray and brown, very fine grained SAND and Silty SAND, poorly graded. (SM-SP)

Environmental Resources Management

Drilling Log

Project: Unison | Owner: Union Carbide Corp.

Location: Kansas City, KS | W.O. Number: K41001.0

Number: S-1 | Total Depth: 60 ft. | Diameter 3-7/8" - 4"

Surface Elevation: 745 msl | Water Level: Init: N/A | 24 hrs N/A

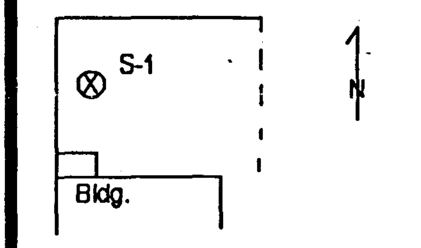
Screen: Dia: N/A | Length: N/A | Slot Size: N/A

Casing: Dia: N/A | Length: N/A | Type: N/A

Drilling Company: Layne Western | Drilling Method: Rotary Mud

Driller: O.J. Harper | Log By: MM Katzman | Date: 4/20/94

Sketch Map



Notes

Depth (Feet)	Recovery	SPT	Sample Number	Description/Soil Classification (Color, Texture, Structures)
13				Same: medium dense thin bedded, gray and brown very fine SAND and Silty SAND - poorly graded. (SM-SP)
14	18/24	7 8 6 8	S17	Medium dense, thin bedded/laminated gray brown low plastic Sandy SILT with thin clay laminates. (SM)
16	12/24	8 13 15 15	S18	Medium dense, thin bedded mixed very fine Silty SAND and Sandy SILT with fine sand. (SMw/SP Medium dense, light gray to brown, very fine to medium grained SAND with tr. siilt - poorly graded - dry (SP)
18	14/24	12 12 12 13	S19	with thin black lignite/organic layer at 19ft. Becoming brown gray and fine to medium grained - saturated (continued water loss, approximately 30% DWL).
20	10/24	1 3 7 14	S110	Becoming loose and medium grained with tr. of fine sand. (SP)
22	9/18	19 20 24	S111	Becoming dense and medium grained with thin lenses of brown sand and black lignite streaks and tr. fine gravel.
24	6/18	13 24 31	S112	Becoming very dense and medium grained with some coarse sand and tr. fine gravel with lignite. (SP)
25 – 26				Becoming medium to fine SAND with tr. of coarse sand and some silt. (SP)

Environmental Resources Management

Drilling Log

Project: Unison | Owner: Union Carbide Corp.

Location: Kansas City, KS | W.O. Number: K41001.0

Number: S-1 | Total Depth: 60 ft. | Diameter: 3-7/8" - 4"

Surface Elevation: 745 msl | Water Level: Init: N/A | 24 hrs: N/A

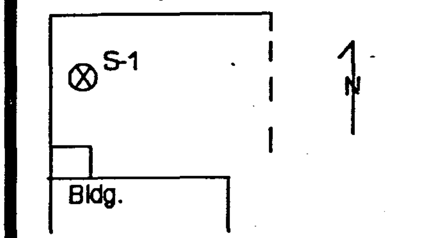
Screen: Dia: N/A | Length: N/A | Slot Size: N/A

Casing: Dia: N/A | Length: N/A | Type: N/A

Drilling Company: Layne Western | Drilling Method: Rotary Mud

Driller: O.J. Harper | Log By: MM Katzman | Date: 4/20/94

Sketch Map



Notes

Depth (Feet)	Recovery	SPT	Sample Number	Description/Soil Classification (Color, Texture, Structures)
26	11/18	12 24 27	S113	Same: Very dense, medium to fine SAND with tr. of coarse sand and some silt, with fine lignite, poorly graded, brown with some gray. (SP)
27				
28	7/18	15 13 10	S114	Becoming fine grained with tr. medium sand and tr. of Silt with SILT lenses. (W/SM) Reamed with 5-7/8" fishtail, set 4" casing with bentonite seal to 30 ft.
29				
30	5/18	4 5 4	S115	Loose, gray, very fine grained SAND, poorly graded to Silty SAND with tr. medium sand and silt with coal/lignite bed at 31.5 ft. (SP-SM)
31				
32	8/18	11 15 23	S116	Dense, dark gray, poorly graded and fine grained Silty SAND with lignite and traces of medium sand. (SM)
33				
34	11/18	11 24 26	S117	Becoming fine grained. Becoming dense - as above (SM) with clay gull at tip.
35				
36	7/18	10 13 20	S118	Becoming medium dense, traces of medium sand. (SM)
37				
38	11/18	7 10 13	S119	Medium dense with wood chips at top of sample and 1" lignite bed at base of sample.
39				

Environmental Resources Management

Drilling Log

Project: Unison | Owner: Union Carbide Corp.

Location: Kansas City, KS | W.O. Number: K41001.0

Number: S-1 | Total Depth: 60 ft. | Diameter: 3-7/8" - 4"

Surface Elevation: 745msl | Water Level: Init: N/A | 24 hrs: N/A

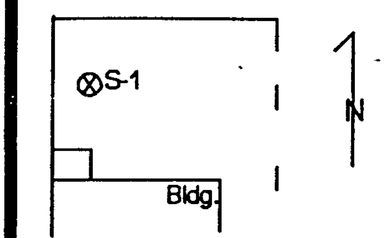
Screen: Dia: N/A | Length: N/A | Slot Size: N/A

Casing: Dia: N/A | Length: N/A | Type: N/A

Drilling Company: Layne Western | Drilling Method: Rotary Mud

Driller: O.J. Harper | Log By: MM Katzman | Date: 4/20/94

Sketch Map



Notes

Depth (Feet)	Recovery	SPT	Sample Number	Description/Soil Classification (Color, Texture, Structures)
39				SAME: Medium dense with wood chips at top of sample and 1" lignite bed at base of sample.
				Very dense, poorly graded interbedded fine SAND and Silty SAND. (SM-SP)
40	11/18	9 24 30	S120	Layered with lignite.
41				
42	12/17	16 41 50/5"	S121	
43				As above, with some medium grained SAND with tr. of powdered rock on tip.
				Dense, fine grained, gray, poorly graded SAND with some silt and tr. of coarse sand. (SP)
44	9/18	15 19 15	S122	
45				
46	6/18	9 12 16	S123	Becoming medium dense.
47				Medium dense, medium grained, poorly graded dark gray SAND with tr. fine sand and some coarse grained sand. (SP)
48	3/18	10 29 36	S124	
49				Dense fine to medium grained, gray, poorly graded SAND with lenses of Silty SAND and thin (1") lens of fine gravel, with 2" thick lignite rich zone. (SP w/ SM)
50	12/18	19 24 26	S125	Dense, gray, very Silty SAND with traces of gravel and coarse sand, poorly graded thinly laminated/bedded. (SM)
51				
52				

Environmental Resources Management

Drilling Log

Project: Unison Owner: Union Carbide Corp.

Location: Kansas City, KS W.O. Number: K41001.0

Number: S-1 Total Depth: 60 ft. Diameter: 3-7/8" - 4"

Surface Elevation: 745msl Water Level: Init: N/A 24 hrs: N/A

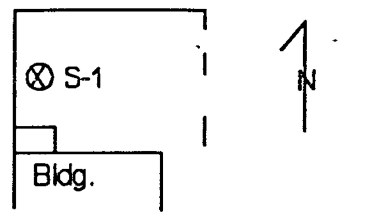
Screen: Dia: N/A Length: N/A Slot Size: N/A

Casing: Dia: N/A Length: N/A Type: N/A

Drilling Company: Layne Western Drilling Method: Rotary Mud

Driller: O.J. Harper Log By: MM Katzman Date: 4/20/94

Sketch Map



Notes

Depth (Feet)	Recovery	SPT	Sample Number	Description/Soil Classification (Color, Texture, Structures)
52	10/18	14 12 11	S126	SAME: Dense, gray, very Silty SAND with tr. of gravel and coarse sand, poorly graded, thinly laminated/bedded. (SM) Becoming medium dense with lignite gravel.
53				
54	18/18	3 6 7	S127	Interbedded, medium dense gray Clayey SILT with thin laminae/beds of stiff Silty CLAY with some Sandy SILT - with traces fine sand with thin (1/8") lignite lenses. (ML w/ OL & SM)
55				
56	8/18	7 18 21	S128	Dense, very fine grained Silty SAND, gray with tr. of medium sand, laminated with lignite. (SM) Dense, medium to coarse grained, poorly graded gray SAND with some fine sand. (SP)
57				
58	12/24	13 14 14 15	S129	Becoming medium dense, fine grained SAND, gray, poorly graded. (SP) Medium dense, gray, coarse grained, poorly graded SAND with traces of medium grained sand with fine gravel in tip. (SP)
59				
60				

Bottom of boring 60 ft. 4/20/94.
Boring grouted 4/21/94.

APPENDIX C

pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Unison Transformer Services
126 Brinkerhoff Road
ansas City, KS 66115

May 16, 1994
PACE Project Number: 54051051

ttn: Mr. Mark Liggatt

Client Reference: Well Sampling

CE Sample Number: 60 0067996
te Collected: 05/10/94
Date Received: 05/10/94

rameter	Units	MDL	PZ 1A	METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
ethyl chloride (Chloromethane)	ug/L	200	ND		05/13/94
ethyl bromide (Bromomethane)	ug/L	200	ND		05/13/94
yl Chloride	ug/L	200	ND		05/13/94
oroethane	ug/L	200	ND		05/13/94
ethylene Chloride	ug/L	100	ND		05/13/94
cetone	ug/L	200	ND		05/13/94
bon Disulfide	ug/L	100	ND		05/13/94
,1-Dichloroethylene	ug/L	100	ND		05/13/94
-Dichloroethane	ug/L	100	ND		05/13/94
-Dichloroethylene (Total)	ug/L	100	2100		05/13/94
hloroform	ug/L	100	ND		05/13/94
,2-Dichloroethane	ug/L	100	ND		05/13/94
-tanone (MEK)	ug/L	100	ND		05/13/94
,1,1-Trichloroethane	ug/L	100	ND		05/13/94
arbon Tetrachloride	ug/L	100	ND		05/13/94
l Acetate	ug/L	100	ND		05/13/94
lorobromomethane	ug/L	100	ND		05/13/94
2-Dichloropropane	ug/L	100	ND		05/13/94
,3-Dichloropropene	ug/L	100	ND		05/13/94
chloroethylene	ug/L	100	2400		05/13/94
lorodibromomethane	ug/L	100	ND		05/13/94
-Trichloroethane	ug/L	100	ND		05/13/94
ene	ug/L	100	ND		05/13/94
ans-1,3-Dichloropropene	ug/L	100	ND		05/13/94
form	ug/L	100	ND		05/13/94
hyl-2-Pentanone (MIBK)	ug/L	100	ND		05/13/94
exanone	ug/L	100	ND		05/13/94
rachloroethylene	ug/L	100	ND		05/13/94
,2-Tetrachloroethane	ug/L	100	ND		05/13/94

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 2

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

PACE Sample Number:			60 0067996		
Date Collected:			05/10/94		
Date Received:			05/10/94		
Client Sample ID:			PZ 1A		
Parameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Toluene	ug/L	100	ND		05/13/94
Chlorobenzene	ug/L	100	ND		05/13/94
Ethylbenzene	ug/L	100	ND		05/13/94
Styrene	ug/L	100	ND		05/13/94
Xylenes (Total)	ug/L	100	ND		05/13/94
Dichlorodifluoromethane	ug/L	200	ND		05/13/94
Trichlorofluoromethane	ug/L	100	ND		05/13/94
Acrolein	ug/L	2000	ND		05/13/94
Acrylonitrile	ug/L	2000	ND		05/13/94
Iodomethane	ug/L	100	ND		05/13/94
Dibromomethane	ug/L	100	ND		05/13/94
2-Chloroethylvinyl ether (mixed)	ug/L	100	ND		05/13/94
Ethylmethacrylate	ug/L	100	ND		05/13/94
1,2,3-Trichloropropane	ug/L	100	ND		05/13/94
1,4-Dichloro-2-butene	ug/L	100	ND		05/13/94
1,3-Dichlorobenzene	ug/L	100	ND		05/13/94
1,4-Dichlorobenzene	ug/L	100	ND		05/13/94
1,2-Dichlorobenzene	ug/L	100	ND		05/13/94
1,2-Dichloroethane-d4 (Surrogate)	%		99		05/13/94
Toluene-d8 (Surrogate)	%		104		05/13/94
4-Bromofluorobenzene (Surrogate)	%		103		05/13/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
Aroclor 1221	ug/L	2.0	ND		05/13/94
Aroclor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
Aroclor 1248	ug/L	1.0	ND		05/13/94
Aroclor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
Decachlorobiphenyl Surrogate	%		125		05/13/94
Tetrachloro-meta-xylene Surrogate	%		88		05/13/94

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 3

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

ACE Sample Number:			60 0067996		
Date Collected:			05/10/94		
Date Received:			05/10/94		
lient Sample ID:			PZ 1A		
arameter	Units	MDL		METHOD	DATE ANALYZED
RGANIC ANALYSIS					
ESTICIDES/PCBS				8080/608	
Dibutylchlorendate (Surrogate)	%		63		05/13/94
sticides Prep			05/11/94		

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...richloroethylene	ug/L	2500	25000	05/13/94
h rodibromomethane	ug/L	2500	ND	05/13/94
,1,2-Trichloroethane	ug/L	2500	ND	05/13/94

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REPORT OF LABORATORY ANALYSIS

fr. Mark Liggatt
'a[redacted]e 4

May 16, 1994
PACE Project Number: 540510512

:lient Reference: Well Sampling

'A[redacted]E Sample Number:			60 0068003		
Date Collected:			05/10/94		
Date Received:			05/10/94		
:[redacted]ent Sample ID:			PZ 2A		
'[redacted]ameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Methyl chloride (Chloromethane)	ug/L	5000	ND		05/13/94
[redacted]hyl bromide (Bromomethane)	ug/L	5000	ND		05/13/94
/[redacted]yl Chloride	ug/L	5000	ND		05/13/94
:hloroethane	ug/L	5000	ND		05/13/94
[redacted]hylene Chloride	ug/L	2500	ND		05/13/94
[redacted]tone	ug/L	5000	ND		05/13/94
:arbon Disulfide	ug/L	2500	ND		05/13/94
l[redacted]-Dichloroethylene	ug/L	2500	ND		05/13/94
l[redacted]-Dichloroethane	ug/L	2500	ND		05/13/94
l,2-Dichloroethylene (Total)	ug/L	2500	ND		05/13/94
:[redacted]oroform	ug/L	2500	ND		05/13/94
l[redacted]-Dichloroethane	ug/L	2500	ND		05/13/94
2-Butanone (MEK)	ug/L	2500	ND		05/13/94
1[redacted],1-Trichloroethane	ug/L	2500	ND		05/13/94
:[redacted]bon Tetrachloride	ug/L	2500	ND		05/13/94
/inyl Acetate	ug/L	2500	ND		05/13/94
)[redacted]chlorobromomethane	ug/L	2500	ND		05/13/94
l[redacted]-Dichloropropane	ug/L	2500	ND		05/13/94
:is-1,3-Dichloropropene	ug/L	2500	ND		05/13/94
T[redacted]chloroethylene	ug/L	2500	25000		05/13/94
:[redacted]orodibromomethane	ug/L	2500	ND		05/13/94
l,1,2-Trichloroethane	ug/L	2500	ND		05/13/94
3[redacted]zene	ug/L	2500	ND		05/13/94
T[redacted]ns-1,3-Dichloropropene	ug/L	2500	ND		05/13/94
3romoform	ug/L	2500	ND		05/13/94
[redacted]ethyl-2-Pentanone (MIBK)	ug/L	2500	ND		05/13/94
2[redacted]exanone	ug/L	2500	ND		05/13/94
Tetrachloroethylene	ug/L	2500	ND		05/13/94
l[redacted],2,2-Tetrachloroethane	ug/L	2500	ND		05/13/94
T[redacted]uene	ug/L	2500	ND		05/13/94
:hlorobenzene	ug/L	2500	ND		05/13/94

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 5

May 16, 1994
PACE Project Number: 54051051

lient Reference: Well Sampling

ACE Sample Number:			60 0068003		
Date Collected:			05/10/94		
te Received:			05/10/94		
ient Sample ID:			PZ 2A		
Parameter	Units	MDL		METHOD	DATE ANALYZED
GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
hylbenzene	ug/L	2500	ND		05/13/94
yrene	ug/L	2500	ND		05/13/94
Xylenes (Total)	ug/L	2500	ND		05/13/94
Dichlorodifluoromethane	ug/L	5000	ND		05/13/94
ichlorofluoromethane	ug/L	2500	ND		05/13/94
Acrolein	ug/L	50000	ND		05/13/94
rylonitrile	ug/L	50000	ND		05/13/94
domethane	ug/L	2500	ND		05/13/94
Dibromomethane	ug/L	2500	ND		05/13/94
2-Chloroethylvinyl ether (mixed)	ug/L	2500	ND		05/13/94
hylmethacrylate	ug/L	2500	ND		05/13/94
1,2,3-Trichloropropane	ug/L	2500	ND		05/13/94
4-Dichloro-2-butene	ug/L	2500	ND		05/13/94
3-Dichlorobenzene	ug/L	2500	ND		05/13/94
1,4-Dichlorobenzene	ug/L	2500	ND		05/13/94
1,2-Dichlorobenzene	ug/L	2500	ND		05/13/94
2-Dichloroethane-d4 (Surrogate)	%		102		05/13/94
uene-d8 (Surrogate)	%		102		05/13/94
Bromofluorobenzene (Surrogate)	%		102		05/13/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
clor 1221	ug/L	2.0	ND		05/13/94
clor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
clor 1248	ug/L	1.0	ND		05/13/94
clor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
achlorobiphenyl Surrogate	%		143		05/13/94
rachloro-meta-xylene Surrogate	%		90		05/13/94
Dibutylchlorendate (Surrogate)	%		87		05/13/94
ticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

Ir[redacted] Mark Liggatt
'[redacted]e 6

May 16, 1994
PACE Project Number: 540510512

:li[redacted]nt Reference: Well Sampling

A[redacted] Sample Number:			60 0068011		
ate Collected:			05/10/94		
'[redacted] Received:			05/10/94		
1[redacted]nt Sample ID:			PZ 3A		
arameter	Units	MDL		METHOD	DATE ANALYZED
R[redacted]ANIC ANALYSIS					
OLATILE ORGANICS				8240	
e[redacted]yl chloride (Chloromethane)	ug/L	500	ND		05/13/94
e[redacted]yl bromide (Bromomethane)	ug/L	500	ND		05/13/94
inyl Chloride	ug/L	500	ND		05/13/94
h[redacted]roethane	ug/L	500	ND		05/13/94
e[redacted]ylene Chloride	ug/L	250	ND		05/13/94
cetone	ug/L	500	ND		05/13/94
a[redacted]on Disulfide	ug/L	250	ND		05/13/94
,[redacted]Dichloroethylene	ug/L	250	ND		05/13/94
,1-Dichloroethane	ug/L	250	ND		05/13/94
,2-Dichloroethylene (Total)	ug/L	250	290		05/13/94
i[redacted]roform	ug/L	250	ND		05/13/94
,[redacted]Dichloroethane	ug/L	250	ND		05/13/94
-[redacted]tanone (MEK)	ug/L	250	ND		05/13/94
,[redacted]1-Trichloroethane	ug/L	250	ND		05/13/94
arbon Tetrachloride	ug/L	250	ND		05/13/94
inyl Acetate	ug/L	250	ND		05/13/94
i[redacted]lorobromomethane	ug/L	250	ND		05/13/94
2[redacted]Dichloropropane	ug/L	250	ND		05/13/94
[redacted]1,3-Dichloropropene	ug/L	250	ND		05/13/94
[redacted]hloroethylene	ug/L	250	4100		05/13/94
lorodibromomethane	ug/L	250	ND		05/13/94
1,2-Trichloroethane	ug/L	250	ND		05/13/94
n[redacted]ene	ug/L	250	ND		05/13/94
[redacted]s-1,3-Dichloropropene	ug/L	250	ND		05/13/94
[redacted]oform	ug/L	250	ND		05/13/94
M[redacted]thyl-2-Pentanone (MIBK)	ug/L	250	ND		05/13/94
Hexanone	ug/L	250	ND		05/13/94
trachloroethylene	ug/L	250	ND		05/13/94
1[redacted]2,2-Tetrachloroethane	ug/L	250	ND		05/13/94
1[redacted]ene	ug/L	250	ND		05/13/94
1[redacted]robenzene	ug/L	250	ND		05/13/94

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 7

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

PACE Sample Number:			60 0068011		
Date Collected:			05/10/94		
Date Received:			05/10/94		
Client Sample ID:			PZ 3A		
Parameter	**Units**	**MDL**		**METHOD**	**DATE ANALYZED**
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Ethylbenzene	ug/L	250	ND		05/13/94
Styrene	ug/L	250	ND		05/13/94
Xylenes (Total)	ug/L	250	ND		05/13/94
Dichlorodifluoromethane	ug/L	500	ND		05/13/94
Trichlorofluoromethane	ug/L	250	ND		05/13/94
Acrolein	ug/L	5000	ND		05/13/94
Acrylonitrile	ug/L	5000	ND		05/13/94
Iodomethane	ug/L	250	ND		05/13/94
Dibromomethane	ug/L	250	ND		05/13/94
2-Chloroethylvinyl ether (mixed)	ug/L	250	ND		05/13/94
Ethylmethacrylate	ug/L	250	ND		05/13/94
1,2,3-Trichloropropane	ug/L	250	ND		05/13/94
1,4-Dichloro-2-butene	ug/L	250	ND		05/13/94
1,3-Dichlorobenzene	ug/L	250	ND		05/13/94
1,4-Dichlorobenzene	ug/L	250	ND		05/13/94
1,2-Dichlorobenzene	ug/L	250	ND		05/13/94
1,2-Dichloroethane-d4 (Surrogate)	%		101		05/13/94
Toluene-d8 (Surrogate)	%		102		05/13/94
4-Bromofluorobenzene (Surrogate)	%		100		05/13/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
Aroclor 1221	ug/L	2.0	ND		05/13/94
Aroclor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
Aroclor 1248	ug/L	1.0	ND		05/13/94
Aroclor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
Decachlorobiphenyl Surrogate	%		125		05/13/94
Tetrachloro-meta-xylene Surrogate	%		94		05/13/94
Dibutylchlorendate (Surrogate)	%		68		05/13/94
Pesticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

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ge 8

May 16, 1994
PACE Project Number: 54051051

ient Reference: Well Sampling

ACE Sample Number:			60 0068020		
ate Collected:			05/10/94		
te Received:			05/10/94		
ient Sample ID:			PZ 4A		
Parameter	Units	MDL		METHOD	DATE ANALYZED
GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
thyl chloride (Chloromethane)	ug/L	10	ND		05/12/94
thyl bromide (Bromomethane)	ug/L	10	ND		05/12/94
Vinyl Chloride	ug/L	10	ND		05/12/94
loroethane	ug/L	10	ND		05/12/94
thylene Chloride	ug/L	5	ND		05/12/94
Acetone	ug/L	10	ND		05/12/94
rbon Disulfide	ug/L	5	ND		05/12/94
1-Dichloroethylene	ug/L	5	ND		05/12/94
1,1-Dichloroethane	ug/L	5	ND		05/12/94
2-Dichloroethylene (Total)	ug/L	5	13		05/12/94
loroform	ug/L	5	ND		05/12/94
,2-Dichloroethane	ug/L	5	ND		05/12/94
Butanone (MEK)	ug/L	5	ND		05/12/94
1,1-Trichloroethane	ug/L	5	ND		05/12/94
Carbon Tetrachloride	ug/L	5	ND		05/12/94
inyl Acetate	ug/L	5	ND		05/12/94
chlorobromomethane	ug/L	5	ND		05/12/94
,2-Dichloropropane	ug/L	5	ND		05/12/94
s-1,3-Dichloropropene	ug/L	5	ND		05/12/94
ichloroethylene	ug/L	5	88		05/12/94
Chlorodibromomethane	ug/L	5	ND		05/12/94
1,1,2-Trichloroethane	ug/L	5	ND		05/12/94
nzene	ug/L	5	ND		05/12/94
ans-1,3-Dichloropropene	ug/L	5	ND		05/12/94
omoform	ug/L	5	ND		05/12/94
Methyl-2-Pentanone (MIBK)	ug/L	5	ND		05/12/94
2-Hexanone	ug/L	5	ND		05/12/94
Tetrachloroethylene	ug/L	5	ND		05/12/94
1,2,2-Tetrachloroethane	ug/L	5	ND		05/12/94
luene	ug/L	5	ND		05/12/94
lorobenzene	ug/L	5	ND		05/12/94

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REPORT OF LABORATORY ANALYSIS

Ir[redacted] Mark Liggatt
'age 9

May 16, 1994
PACE Project Number: 540510512

:l[redacted]ent Reference: Well Sampling

'ACE Sample Number:			60 0068020		
)ate Collected:			05/10/94		
)a[redacted] Received:			05/10/94		
:l[redacted]ent Sample ID:			PZ 4A		
'arameter	Units	MDL		METHOD	DATE ANALYZED
)R[redacted]ANIC ANALYSIS					
VOLATILE ORGANICS				8240	
E[redacted]ylbenzene	ug/L	5	ND		05/12/94
S[redacted]yrene	ug/L	5	ND		05/12/94
Xylenes (Total)	ug/L	5	ND		05/12/94
D[redacted]hlorodifluoromethane	ug/L	10	ND		05/12/94
T[redacted]chlorofluoromethane	ug/L	5	ND		05/12/94
Acrolein	ug/L	100	ND		05/12/94
A[redacted]ylonitrile	ug/L	100	ND		05/12/94
I[redacted]omethane	ug/L	5	ND		05/12/94
Dibromomethane	ug/L	5	ND		05/12/94
2[redacted]hloroethylvinyl ether (mixed)	ug/L	5	ND		05/12/94
E[redacted]ylmethacrylate	ug/L	5	ND		05/12/94
1,2,3-Trichloropropane	ug/L	5	ND		05/12/94
1[redacted]-Dichloro-2-butene	ug/L	5	ND		05/12/94
1[redacted]-Dichlorobenzene	ug/L	5	ND		05/12/94
1,4-Dichlorobenzene	ug/L	5	ND		05/12/94
1[redacted]2-Dichlorobenzene	ug/L	5	ND		05/12/94
1[redacted]2-Dichloroethane-d4 (Surrogate)	%		96		05/12/94
Toluene-d8 (Surrogate)	%		100		05/12/94
4[redacted]Bromofluorobenzene (Surrogate)	%		100		05/12/94
PESTICIDES/PCBS				8080/608	
A[redacted]oclor 1016	ug/L	1.0	ND		05/13/94
[redacted]oclor 1221	ug/L	2.0	ND		05/13/94
Aroclor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
[redacted]oclor 1248	ug/L	1.0	ND		05/13/94
[redacted]oclor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
[redacted]cachlorobiphenyl Surrogate	%		116		05/13/94
Tetrachloro-meta-xylene Surrogate	%		90		05/13/94
Dibutylchlorendate (Surrogate)	%		69		05/13/94
[redacted]sticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 10

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

PACE Sample Number:			60 0068038		
Date Collected:			05/10/94		
Date Received:			05/10/94		
Client Sample ID:			MW 11A		
Parameter	**Units**	**MDL**		**METHOD**	**DATE ANALYZED**
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Methyl chloride (Chloromethane)	ug/L	20000	ND		05/14/94
Methyl bromide (Bromomethane)	ug/L	20000	ND		05/14/94
Vinyl Chloride	ug/L	20000	ND		05/14/94
Chloroethane	ug/L	20000	ND		05/14/94
Methylene Chloride	ug/L	10000	ND		05/14/94
Acetone	ug/L	20000	ND		05/14/94
Carbon Disulfide	ug/L	10000	ND		05/14/94
1,1-Dichloroethylene	ug/L	10000	ND		05/14/94
1,1-Dichloroethane	ug/L	10000	ND		05/14/94
1,2-Dichloroethylene (Total)	ug/L	10000	120000		05/14/94
Chloroform	ug/L	10000	ND		05/14/94
1,2-Dichloroethane	ug/L	10000	ND		05/14/94
2-Butanone (MEK)	ug/L	10000	ND		05/14/94
1,1,1-Trichloroethane	ug/L	10000	ND		05/14/94
Carbon Tetrachloride	ug/L	10000	ND		05/14/94
Vinyl Acetate	ug/L	10000	ND		05/14/94
Dichlorobromomethane	ug/L	10000	ND		05/14/94
1,2-Dichloropropane	ug/L	10000	ND		05/14/94
Cis-1,3-Dichloropropene	ug/L	10000	ND		05/14/94
Trichloroethylene	ug/L	10000	360000		05/14/94
Chlorodibromomethane	ug/L	10000	ND		05/14/94
1,1,2-Trichloroethane	ug/L	10000	ND		05/14/94
Benzene	ug/L	10000	ND		05/14/94
Trans-1,3-Dichloropropene	ug/L	10000	ND		05/14/94
Bromoform	ug/L	10000	ND		05/14/94
4-Methyl-2-Pentanone (MIBK)	ug/L	10000	ND		05/14/94
2-Hexanone	ug/L	10000	ND		05/14/94
Tetrachloroethylene	ug/L	10000	ND		05/14/94
1,1,2,2-Tetrachloroethane	ug/L	10000	ND		05/14/94
Toluene	ug/L	10000	ND		05/14/94
Chlorobenzene	ug/L	10000	ND		05/14/94

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REPORT OF LABORATORY ANALYSIS

M[redacted] Mark Liggatt
P[redacted]e 11

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
PA[redacted]E Sample Number:			60 0068038		
Date Collected:			05/10/94		
Da[redacted]e Received:			05/10/94		
C[redacted]ent Sample ID:			MW 11A		
OR[redacted]ANIC ANALYSIS					
/OLATILE ORGANICS				8240	
:t[redacted]ylbenzene	ug/L	10000	ND		05/14/94
St[redacted]rene	ug/L	10000	ND		05/14/94
(y[redacted]enes (Total)	ug/L	10000	ND		05/14/94
)ichlorodifluoromethane	ug/L	20000	ND		05/14/94
Tr[redacted]chlorofluoromethane	ug/L	10000	ND		05/14/94
\c[redacted]olein	ug/L	200000	ND		05/14/94
\c[redacted]ylonitrile	ug/L	200000	ND		05/14/94
Io[redacted]omethane	ug/L	10000	ND		05/14/94
)ibromomethane	ug/L	10000	ND		05/14/94
!-Chloroethylvinyl ether (mixed)	ug/L	10000	ND		05/14/94
:t[redacted]ylmethacrylate	ug/L	10000	ND		05/14/94
,[redacted]3-Trichloropropane	ug/L	10000	ND		05/14/94
.,[redacted]-Dichloro-2-butene	ug/L	10000	ND		05/14/94
,[redacted]-Dichlorobenzene	ug/L	10000	ND		05/14/94
,[redacted]-Dichlorobenzene	ug/L	10000	ND		05/14/94
,2-Dichlorobenzene	ug/L	10000	ND		05/14/94
,[redacted]-Dichloroethane-d4 (Surrogate)	%		106		05/14/94
o[redacted]uene-d8 (Surrogate)	%		103		05/14/94
-Bromofluorobenzene (Surrogate)	%		101		05/14/94
E[redacted]TICIDES/PCBS				8080/608	
roclor 1016	ug/L	1.0	ND		05/13/94
r[redacted]lor 1221	ug/L	2.0	ND		05/13/94
r[redacted]lor 1232	ug/L	1.0	ND		05/13/94
roclor 1242	ug/L	1.0	1.06		05/13/94
roclor 1248	ug/L	1.0	ND		05/13/94
r[redacted]lor 1254	ug/L	1.0	ND		05/13/94
roclor 1260	ug/L	1.0	3.87		05/13/94
e[redacted]chlorobiphenyl Surrogate	%		190 (1)		05/13/94
e[redacted]achloro-meta-xylene Surrogate	%		66		05/13/94
ibutylchlorendate (Surrogate)	%		56		05/13/94
esticides Prep			05/13/94		

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REPORT OF LABORATORY ANALYSIS

M[redacted]. Mark Liggatt
[redacted]ge 12

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
P[redacted]CE Sample Number:			60 0068046		
Date Collected:			05/10/94		
[redacted]te Received:			05/10/94		
C[redacted]ient Sample ID:			MW 12A		
C[redacted]GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
M[redacted]thyl chloride (Chloromethane)	ug/L	10000	ND		05/14/94
M[redacted]thyl bromide (Bromomethane)	ug/L	10000	ND		05/14/94
Vinyl Chloride	ug/L	10000	ND		05/14/94
Chloroethane	ug/L	10000	ND		05/14/94
M[redacted]thylene Chloride	ug/L	5000	ND		05/14/94
Acetone	ug/L	10000	ND		05/14/94
C[redacted]rbon Disulfide	ug/L	5000	ND		05/14/94
1[redacted]1-Dichloroethylene	ug/L	5000	ND		05/14/94
1,1-Dichloroethane	ug/L	5000	ND		05/14/94
1,2-Dichloroethylene (Total)	ug/L	5000	69000		05/14/94
C[redacted]loroform	ug/L	5000	ND		05/14/94
1[redacted]2-Dichloroethane	ug/L	5000	ND		05/14/94
2[redacted]Butanone (MEK)	ug/L	5000	ND		05/14/94
1[redacted],1-Trichloroethane	ug/L	5000	ND		05/14/94
Carbon Tetrachloride	ug/L	5000	ND		05/14/94
Vinyl Acetate	ug/L	5000	ND		05/14/94
D[redacted]chlorobromomethane	ug/L	5000	ND		05/14/94
1[redacted]2-Dichloropropane	ug/L	5000	ND		05/14/94
C[redacted]s-1,3-Dichloropropene	ug/L	5000	ND		05/14/94
T[redacted]chloroethylene	ug/L	5000	96000		05/14/94
Chlorodibromomethane	ug/L	5000	ND		05/14/94
1,1,2-Trichloroethane	ug/L	5000	ND		05/14/94
B[redacted]zene	ug/L	5000	ND		05/14/94
T[redacted]ns-1,3-Dichloropropene	ug/L	5000	ND		05/14/94
B[redacted]omoform	ug/L	5000	ND		05/14/94
4[redacted]ethyl-2-Pentanone (MIBK)	ug/L	5000	ND		05/14/94
2[redacted]exanone	ug/L	5000	ND		05/14/94
Tetrachloroethylene	ug/L	5000	ND		05/14/94
1[redacted],2,2-Tetrachloroethane	ug/L	5000	ND		05/14/94
T[redacted]uene	ug/L	5000	ND		05/14/94
Chlorobenzene	ug/L	5000	ND		05/14/94

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REPORT OF LABORATORY ANALYSIS

M[redacted] Mark Liggatt
P[redacted]e 13

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

P[redacted]E Sample Number:			60 0068046		
Date Collected:			05/10/94		
Da[redacted]e Received:			05/10/94		
C[redacted]ent Sample ID:			MW 12A		
Parameter	Units	MDL		METHOD	DATE ANALYZED
[redacted]ANIC ANALYSIS					
/OLATILE ORGANICS				8240	
:[redacted]ylbenzene	ug/L	5000	ND		05/14/94
;[redacted]rene	ug/L	5000	ND		05/14/94
[redacted]enes (Total)	ug/L	5000	ND		05/14/94
ichlorodifluoromethane	ug/L	10000	ND		05/14/94
[redacted]chlorofluoromethane	ug/L	5000	ND		05/14/94
[redacted]lein	ug/L	100000	ND		05/14/94
[redacted]lonitrile	ug/L	100000	ND		05/14/94
[redacted]methane	ug/L	5000	ND		05/14/94
[redacted]bromomethane	ug/L	5000	ND		05/14/94
:-Chloroethylvinyl ether (mixed)	ug/L	5000	ND		05/14/94
[redacted]ylmethacrylate	ug/L	5000	ND		05/14/94
,[redacted]3-Trichloropropane	ug/L	5000	ND		05/14/94
,[redacted]Dichloro-2-butene	ug/L	5000	ND		05/14/94
,[redacted]Dichlorobenzene	ug/L	5000	ND		05/14/94
,[redacted]Dichlorobenzene	ug/L	5000	ND		05/14/94
,2-Dichlorobenzene	ug/L	5000	ND		05/14/94
,[redacted]Dichloroethane-d4 (Surrogate)	%		101		05/14/94
o[redacted]ene-d8 (Surrogate)	%		101		05/14/94
-[redacted]omofluorobenzene (Surrogate)	%		99		05/14/94
E[redacted]TICIDES/PCBS				8080/608	
roclor 1016	ug/L	1.0	ND		05/13/94
r[redacted]lor 1221	ug/L	2.0	ND		05/13/94
r[redacted]lor 1232	ug/L	1.0	ND		05/13/94
roclor 1242	ug/L	1.0	ND		05/13/94
r[redacted]lor 1248	ug/L	1.0	ND		05/13/94
r[redacted]lor 1254	ug/L	1.0	ND		05/13/94
roclor 1260	ug/L	1.0	ND		05/13/94
[redacted]chlorobiphenyl Surrogate	%		170 (1)		05/13/94
[redacted]achloro-meta-xylene Surrogate	%		79		05/13/94
butylchlorendate (Surrogate)	%		86		05/13/94
sticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

[redacted]. Mark Liggatt
[redacted]ge 14

May 16, 1994
PACE Project Number: 54051051

[redacted]ient Reference: Well Sampling

[redacted]CE Sample Number:	60 0068054
Date Collected:	05/10/94
[redacted]te Received:	05/10/94
[redacted]ient Sample ID:	MW 12B

Parameter	Units	MDL		METHOD	DATE ANALYZED
[redacted]GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
[redacted]thyl chloride (Chloromethane)	ug/L	2000	ND		05/13/94
[redacted]thyl bromide (Bromomethane)	ug/L	2000	ND		05/13/94
Vinyl Chloride	ug/L	2500	ND		05/13/94
Chloroethane	ug/L	2500	ND		05/13/94
[redacted]thylene Chloride	ug/L	1200	ND		05/13/94
[redacted]etone	ug/L	2500	ND		05/13/94
[redacted]rbon Disulfide	ug/L	1200	ND		05/13/94
[redacted]1-Dichloroethylene	ug/L	1200	ND		05/13/94
1,1-Dichloroethane	ug/L	1200	ND		05/13/94
1,2-Dichloroethylene (Total)	ug/L	1200	8700		05/13/94
[redacted]loroform	ug/L	1200	ND		05/13/94
[redacted]2-Dichloroethane	ug/L	1200	ND		05/13/94
2[redacted]Butanone (MEK)	ug/L	1200	ND		05/13/94
1[redacted],1-Trichloroethane	ug/L	1200	ND		05/13/94
Carbon Tetrachloride	ug/L	1200	ND		05/13/94
Vinyl Acetate	ug/L	1200	ND		05/13/94
[redacted]chlorobromomethane	ug/L	1200	ND		05/13/94
1[redacted]2-Dichloropropane	ug/L	1200	ND		05/13/94
C[redacted]-1,3-Dichloropropene	ug/L	1200	ND		05/13/94
T[redacted]ichloroethylene	ug/L	1200	17000		05/13/94
Chlorodibromomethane	ug/L	1200	ND		05/13/94
1,1,2-Trichloroethane	ug/L	1200	ND		05/13/94
B[redacted]zene	ug/L	1200	ND		05/13/94
T[redacted]ns-1,3-Dichloropropene	ug/L	1200	ND		05/13/94
Bromoform	ug/L	1200	ND		05/13/94
4[redacted]ethyl-2-Pentanone (MIBK)	ug/L	1200	ND		05/13/94
2-Hexanone	ug/L	1200	ND		05/13/94
Tetrachloroethylene	ug/L	1200	ND		05/13/94
1[redacted],2,2-Tetrachloroethane	ug/L	1200	ND		05/13/94
T[redacted]uene	ug/L	1200	ND		05/13/94
Chlorobenzene	ug/L	1200	ND		05/13/94

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 15

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			60 0068054		
Date Collected:			05/10/94		
Date Received:			05/10/94		
Client Sample ID:			MW 12B		
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Ethylbenzene	ug/L	1200	ND		05/13/94
Styrene	ug/L	1200	ND		05/13/94
Xylenes (Total)	ug/L	1200	ND		05/13/94
Dichlorodifluoromethane	ug/L	2500	ND		05/13/94
Trichlorofluoromethane	ug/L	1200	ND		05/13/94
Acrolein	ug/L	25000	ND		05/13/94
Acrylonitrile	ug/L	25000	ND		05/13/94
Iodomethane	ug/L	1200	ND		05/13/94
Dibromomethane	ug/L	1200	ND		05/13/94
2-Chloroethylvinyl ether (mixed)	ug/L	1200	ND		05/13/94
Ethylmethacrylate	ug/L	1200	ND		05/13/94
1,2,3-Trichloropropane	ug/L	1200	ND		05/13/94
1,4-Dichloro-2-butene	ug/L	1200	ND		05/13/94
1,3-Dichlorobenzene	ug/L	1200	ND		05/13/94
1,4-Dichlorobenzene	ug/L	1200	ND		05/13/94
1,2-Dichlorobenzene	ug/L	1200	ND		05/13/94
1,2-Dichloroethane-d4 (Surrogate)	%		93		05/13/94
Toluene-d8 (Surrogate)	%		97		05/13/94
4-Bromofluorobenzene (Surrogate)	%		93		05/13/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
Aroclor 1221	ug/L	2.0	ND		05/13/94
Aroclor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
Aroclor 1248	ug/L	1.0	ND		05/13/94
Aroclor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
Decachlorobiphenyl Surrogate	%		170 (1)		05/13/94
Tetrachloro-meta-xylene Surrogate	%		79		05/13/94
Dibutylchlorendate (Surrogate)	%		84		05/13/94
Pesticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

M[redacted]. Mark Liggatt
[redacted]ge 16

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

P[redacted]CE Sample Number: 60 0068062
Date Collected: 05/10/94
D[redacted]te Received: 05/10/94
C[redacted]ient Sample ID: MW 13A

Parameter	Units	MDL		METHOD	DATE ANALYZED
O[redacted]GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
M[redacted]thyl chloride (Chloromethane)	ug/L	40000	ND		05/14/94
M[redacted]thyl bromide (Bromomethane)	ug/L	40000	ND		05/14/94
V[redacted]nyl Chloride	ug/L	40000	ND		05/14/94
Chloroethane	ug/L	40000	ND		05/14/94
M[redacted]hylene Chloride	ug/L	20000	ND		05/14/94
A[redacted]tone	ug/L	40000	ND		05/14/94
C[redacted]bon Disulfide	ug/L	20000	ND		05/14/94
1[redacted]-Dichloroethylene	ug/L	20000	ND		05/14/94
1,1-Dichloroethane	ug/L	20000	ND		05/14/94
1,2-Dichloroethylene (Total)	ug/L	20000	ND		05/14/94
C[redacted]oroform	ug/L	20000	ND		05/14/94
1[redacted]-Dichloroethane	ug/L	20000	ND		05/14/94
2-Butanone (MEK)	ug/L	20000	ND		05/14/94
1[redacted],1-Trichloroethane	ug/L	20000	ND		05/14/94
arbon Tetrachloride	ug/L	20000	ND		05/14/94
inyl Acetate	ug/L	20000	ND		05/14/94
[redacted]hlorobromomethane	ug/L	20000	ND		05/14/94
1,[redacted]-Dichloropropane	ug/L	20000	ND		05/14/94
is-1,3-Dichloropropene	ug/L	20000	ND		05/14/94
[redacted]chloroethylene	ug/L	20000	670000		05/14/94
[redacted]orodibromomethane	ug/L	20000	ND		05/14/94
,1,2-Trichloroethane	ug/L	20000	ND		05/14/94
Be[redacted]zene	ug/L	20000	ND		05/14/94
[redacted]ns-1,3-Dichloropropene	ug/L	20000	ND		05/14/94
romoform	ug/L	20000	ND		05/14/94
[redacted]ethyl-2-Pentanone (MIBK)	ug/L	20000	ND		05/14/94
[redacted]exanone	ug/L	20000	ND		05/14/94
etrachloroethylene	ug/L	20000	ND		05/14/94
,[redacted]2,2-Tetrachloroethane	ug/L	20000	ND		05/14/94
o[redacted]ene	ug/L	20000	ND		05/14/94
hlorobenzene	ug/L	20000	ND		05/14/94

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REPORT OF LABORATORY ANALYSIS

M[redacted] Mark Liggatt
P[redacted]e 17

May 16, 1994
PACE Project Number: 540510512

C[redacted]ent Reference: Well Sampling

PA[redacted]E Sample Number:			60 0068062		
Date Collected:			05/10/94		
D[redacted]e Received:			05/10/94		
C[redacted]ent Sample ID:			MW 13A		
Parameter	Units	MDL		METHOD	DATE ANALYZED
O[redacted]ANIC ANALYSIS					
VOLATILE ORGANICS				8240	
E[redacted]ylbenzene	ug/L	20000	ND		05/14/94
S[redacted]rene	ug/L	20000	ND		05/14/94
Xylenes (Total)	ug/L	20000	ND		05/14/94
Di[redacted]chlorodifluoromethane	ug/L	40000	ND		05/14/94
T[redacted]chlorofluoromethane	ug/L	20000	ND		05/14/94
Acrolein	ug/L	400000	ND		05/14/94
A[redacted]ylonitrile	ug/L	400000	ND		05/14/94
I[redacted]omethane	ug/L	20000	ND		05/14/94
Dibromomethane	ug/L	20000	ND		05/14/94
2-Chloroethylvinyl ether (mixed)	ug/L	20000	ND		05/14/94
E[redacted]ylmethacrylate	ug/L	20000	ND		05/14/94
1,2,3-Trichloropropane	ug/L	20000	ND		05/14/94
1[redacted]-Dichloro-2-butene	ug/L	20000	ND		05/14/94
1[redacted]-Dichlorobenzene	ug/L	20000	ND		05/14/94
1,4-Dichlorobenzene	ug/L	20000	ND		05/14/94
1,2-Dichlorobenzene	ug/L	20000	ND		05/14/94
1[redacted]-Dichloroethane-d4 (Surrogate)	%		103		05/14/94
T[redacted]uene-d8 (Surrogate)	%		101		05/14/94
4[redacted]romofluorobenzene (Surrogate)	%		98		05/14/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	5.0	ND		05/13/94
A[redacted]clor 1221	ug/L	10	ND		05/13/94
A[redacted]clor 1232	ug/L	5.0	ND		05/13/94
Aroclor 1242	ug/L	5.0	ND		05/13/94
A[redacted]clor 1248	ug/L	5.0	ND		05/13/94
A[redacted]clor 1254	ug/L	5.0	ND		05/13/94
Aroclor 1260	ug/L	5.0	23		05/13/94
[redacted]achlorobiphenyl Surrogate	%		165		05/13/94
[redacted]rachloro-meta-xylene Surrogate	%		87		05/13/94
Dibutylchlorendate (Surrogate)	%		78		05/13/94
P[redacted]ticides Prep			05/11/94		

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

[redacted]. Mark Liggatt
[redacted]ge 18

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
[redacted]CE Sample Number:			60 0068070		
Date Collected:			05/10/94		
[redacted]te Received:			05/10/94		
[redacted]ient Sample ID:			MW 13B		
[redacted]GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
[redacted]thyl chloride (Chloromethane)	ug/L	500	ND		05/14/94
[redacted]thyl bromide (Bromomethane)	ug/L	500	ND		05/14/94
Vinyl Chloride	ug/L	500	ND		05/14/94
Chloroethane	ug/L	500	ND		05/14/94
[redacted]thylene Chloride	ug/L	250	ND		05/14/94
[redacted]etone	ug/L	500	ND		05/14/94
Carbon Disulfide	ug/L	250	ND		05/14/94
[redacted]1-Dichloroethylene	ug/L	250	ND		05/14/94
1,1-Dichloroethane	ug/L	250	ND		05/14/94
1,2-Dichloroethylene (Total)	ug/L	250	ND		05/14/94
[redacted]loroform	ug/L	250	ND		05/14/94
[redacted]2-Dichloroethane	ug/L	250	ND		05/14/94
2-Butanone (MEK)	ug/L	250	ND		05/14/94
[redacted]1,1-Trichloroethane	ug/L	250	ND		05/14/94
Carbon Tetrachloride	ug/L	250	ND		05/14/94
Vinyl Acetate	ug/L	250	ND		05/14/94
[redacted]chlorobromomethane	ug/L	250	ND		05/14/94
[redacted]2-Dichloropropane	ug/L	250	ND		05/14/94
Cis-1,3-Dichloropropene	ug/L	250	ND		05/14/94
[redacted]ichloroethylene	ug/L	250	11000 (2)		05/14/94
Chlorodibromomethane	ug/L	250	ND		05/14/94
1,1,2-Trichloroethane	ug/L	250	ND		05/14/94
[redacted]nzene	ug/L	250	ND		05/14/94
[redacted]ans-1,3-Dichloropropene	ug/L	250	ND		05/14/94
Bromoform	ug/L	250	ND		05/14/94
[redacted]Methyl-2-Pentanone (MIBK)	ug/L	250	ND		05/14/94
[redacted]Hexanone	ug/L	250	ND		05/14/94
Tetrachloroethylene	ug/L	250	ND		05/14/94
[redacted]1,2,2-Tetrachloroethane	ug/L	250	ND		05/14/94
[redacted]uene	ug/L	250	ND		05/14/94
Chlorobenzene	ug/L	250	ND		05/14/94

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THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
[redacted]age 19

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

[redacted]ACE Sample Number: 60 0068070
Date Collected: 05/10/94
Date Received: 05/10/94
[redacted]ient Sample ID: MW 138

[redacted]rameter	Units	MDL		METHOD	DATE ANALYZED
[redacted]RGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Ethylbenzene	ug/L	250	ND		05/14/94
[redacted]yrene	ug/L	250	ND		05/14/94
[redacted]lenes (Total)	ug/L	250	ND		05/14/94
Dichlorodifluoromethane	ug/L	500	ND		05/14/94
[redacted]ichlorofluoromethane	ug/L	250	ND		05/14/94
[redacted]rolein	ug/L	5000	ND		05/14/94
Acrylonitrile	ug/L	5000	ND		05/14/94
[redacted]domethane	ug/L	250	ND		05/14/94
[redacted]bromomethane	ug/L	250	ND		05/14/94
2-Chloroethylvinyl ether (mixed)	ug/L	250	ND		05/14/94
[redacted]hylmethacrylate	ug/L	250	ND		05/14/94
[redacted]2,3-Trichloropropane	ug/L	250	ND		05/14/94
1,4-Dichloro-2-butene	ug/L	250	ND		05/14/94
1[redacted]-Dichlorobenzene	ug/L	250	ND		05/14/94
1[redacted]-Dichlorobenzene	ug/L	250	ND		05/14/94
1,2-Dichlorobenzene	ug/L	250	ND		05/14/94
1,2-Dichloroethane-d4 (Surrogate)	%		102		05/14/94
T[redacted]uene-d8 (Surrogate)	%		101		05/14/94
4-Bromofluorobenzene (Surrogate)	%		98		05/14/94
P[redacted]TICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
Aroclor 1221	ug/L	2.0	ND		05/13/94
A[redacted]clor 1232	ug/L	1.0	ND		05/13/94
A[redacted]clor 1242	ug/L	1.0	ND		05/13/94
Aroclor 1248	ug/L	1.0	ND		05/13/94
A[redacted]clor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	1.81		05/13/94
Decachlorobiphenyl Surrogate	%		190 (1)		05/13/94
[redacted]achloro-meta-xylene Surrogate	%		84		05/13/94
[redacted]utylchlorendate (Surrogate)	%		84		05/13/94
Pesticides Prep			05/11/94		

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pace INCORPORATED
THE ASSURANCE OF QUALITY

REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
Page 20

May 16, 1994
PACE Project Number: 54051051

lient Reference: Well Sampling

PACE Sample Number:			60 0068089		
ate Collected:			05/10/94		
ate Received:			05/10/94		
lient Sample ID:			MW 14A		
Parameter	Units	MDL		METHOD	DATE ANALYZEI
RGANIC ANALYSIS					
OLATILE ORGANICS				8240	
ethyl chloride (Chloromethane)	ug/L	500	ND		05/13/94
ethyl bromide (Bromomethane)	ug/L	500	ND		05/13/94
Vinyl Chloride	ug/L	500	ND		05/13/94
hloroethane	ug/L	500	ND		05/13/94
ethylene Chloride	ug/L	250	ND		05/13/94
Acetone	ug/L	500	ND		05/13/94
arbon Disulfide	ug/L	250	ND		05/13/94
,1-Dichloroethylene	ug/L	250	ND		05/13/94
1,1-Dichloroethane	ug/L	250	ND		05/13/94
,2-Dichloroethylene (Total)	ug/L	250	ND		05/13/94
hloroform	ug/L	250	ND		05/13/94
,2-Dichloroethane	ug/L	250	ND		05/13/94
-Butanone (MEK)	ug/L	250	ND		05/13/94
,1,1-Trichloroethane	ug/L	250	ND		05/13/94
Carbon Tetrachloride	ug/L	250	ND		05/13/94
inyl Acetate	ug/L	250	ND		05/13/94
ichlorobromomethane	ug/L	250	ND		05/13/94
,2-Dichloropropane	ug/L	250	ND		05/13/94
is-1,3-Dichloropropene	ug/L	250	ND		05/13/94
richloroethylene	ug/L	250	9600		05/13/94
Chlorodibromomethane	ug/L	250	ND		05/13/94
,1,2-Trichloroethane	ug/L	250	ND		05/13/94
nzene	ug/L	250	ND		05/13/94
ans-1,3-Dichloropropene	ug/L	250	ND		05/13/94
romoform	ug/L	250	ND		05/13/94
-Methyl-2-Pentanone (MIBK)	ug/L	250	ND		05/13/94
2-Hexanone	ug/L	250	ND		05/13/94
Tetrachloroethylene	ug/L	250	ND		05/13/94
,1,2,2-Tetrachloroethane	ug/L	250	ND		05/13/94
luene	ug/L	250	ND		05/13/94
hlorobenzene	ug/L	250	ND		05/13/94

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REPORT OF LABORATORY ANALYSIS

M[redacted]. Mark Liggatt
P[redacted]ge 21

May 16, 1994
PACE Project Number: 540510512

C[redacted]ient Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
PACE Sample Number:			60 0068089		
[redacted]ate Collected:			05/10/94		
[redacted]te Received:			05/10/94		
C[redacted]ient Sample ID:			MW 14A		
[redacted]GANIC ANALYSIS					
VOLATILE ORGANICS				8240	
[redacted]hylbenzene	ug/L	250	ND		05/13/94
[redacted]yrene	ug/L	250	ND		05/13/94
Xylenes (Total)	ug/L	250	ND		05/13/94
[redacted]chlorodifluoromethane	ug/L	500	ND		05/13/94
[redacted]ichlorofluoromethane	ug/L	250	ND		05/13/94
Acrolein	ug/L	5000	ND		05/13/94
[redacted]rylonitrile	ug/L	5000	ND		05/13/94
[redacted]domethane	ug/L	250	ND		05/13/94
Dibromomethane	ug/L	250	ND		05/13/94
[redacted]-Chloroethylvinyl ether (mixed)	ug/L	250	ND		05/13/94
[redacted]hylmethacrylate	ug/L	250	ND		05/13/94
1,2,3-Trichloropropane	ug/L	250	ND		05/13/94
[redacted]4-Dichloro-2-butene	ug/L	250	ND		05/13/94
[redacted]3-Dichlorobenzene	ug/L	250	ND		05/13/94
1,4-Dichlorobenzene	ug/L	250	ND		05/13/94
1,2-Dichlorobenzene	ug/L	250	ND		05/13/94
[redacted]2-Dichloroethane-d4 (Surrogate)	%		100		05/13/94
Toluene-d8 (Surrogate)	%		100		05/13/94
[redacted]-Bromofluorobenzene (Surrogate)	%		98		05/13/94
PESTICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
[redacted]roclor 1221	ug/L	2.0	ND		05/13/94
Aroclor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
[redacted]roclor 1248	ug/L	1.0	ND		05/13/94
[redacted]roclor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	ND		05/13/94
[redacted]ecachlorobiphenyl Surrogate	%		116		05/13/94
Tetrachloro-meta-xylene Surrogate	%		81		05/13/94
Dibutylchlorendate (Surrogate)	%		65		05/13/94
[redacted]esticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 22

May 16, 1994
PACE Project Number: 54051051

lient Reference: Well Sampling

Parameter	Units	MDL		METHOD	DATE ANALYZED
ACE Sample Number:			60 0068097		
Date Collected:			05/10/94		
ate Received:			05/10/94		
lient Sample ID:			MW 15A		
RGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
ethyl chloride (Chloromethane)	ug/L	2000	ND		05/13/94
ethyl bromide (Bromomethane)	ug/L	2000	ND		05/13/94
Vinyl Chloride	ug/L	2500	ND		05/13/94
hloroethane	ug/L	2500	ND		05/13/94
ethylene Chloride	ug/L	1200	ND		05/13/94
cetone	ug/L	2500	ND		05/13/94
arbon Disulfide	ug/L	1200	ND		05/13/94
1-Dichloroethylene	ug/L	1200	ND		05/13/94
1,1-Dichloroethane	ug/L	1200	ND		05/13/94
2-Dichloroethylene (Total)	ug/L	1200	24000		05/13/94
hloroform	ug/L	1200	ND		05/13/94
,2-Dichloroethane	ug/L	1200	ND		05/13/94
Butanone (MEK)	ug/L	1200	ND		05/13/94
1,1-Trichloroethane	ug/L	1200	ND		05/13/94
Carbon Tetrachloride	ug/L	1200	ND		05/13/94
Vinyl Acetate	ug/L	1200	ND		05/13/94
chlorobromomethane	ug/L	1200	ND		05/13/94
2-Dichloropropane	ug/L	1200	ND		05/13/94
s-1,3-Dichloropropene	ug/L	1200	ND		05/13/94
ichloroethylene	ug/L	1200	37000		05/13/94
Chlorodibromomethane	ug/L	1200	ND		05/13/94
1,1,2-Trichloroethane	ug/L	1200	ND		05/13/94
nzene	ug/L	1200	ND		05/13/94
ans-1,3-Dichloropropene	ug/L	1200	ND		05/13/94
omoform	ug/L	1200	ND		05/13/94
Methyl-2-Pentanone (MIBK)	ug/L	1200	ND		05/13/94
2-Hexanone	ug/L	1200	ND		05/13/94
Tetrachloroethylene	ug/L	1200	ND		05/13/94
1,2,2-Tetrachloroethane	ug/L	1200	ND		05/13/94
luene	ug/L	1200	ND		05/13/94
lorobenzene	ug/L	1200	ND		05/13/94

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REPORT OF LABORATORY ANALYSIS

M[redacted]. Mark Liggatt
[redacted]ge 23

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

[redacted]CE Sample Number:			60 0068097		
Date Collected:			05/10/94		
Date Received:			05/10/94		
[redacted]ient Sample ID:			MW 15A		
[redacted]rameter	Units	MDL		METHOD	DATE ANALYZED
ORGANIC ANALYSIS					
VOLATILE ORGANICS				8240	
Ethylbenzene	ug/L	1200	ND		05/13/94
S[redacted]yrene	ug/L	1200	ND		05/13/94
[redacted]lenes (Total)	ug/L	1200	ND		05/13/94
Dichlorodifluoromethane	ug/L	2500	ND		05/13/94
[redacted]ichlorofluoromethane	ug/L	1200	ND		05/13/94
[redacted]rolein	ug/L	25000	ND		05/13/94
Acrylonitrile	ug/L	25000	ND		05/13/94
I[redacted]domethane	ug/L	1200	ND		05/13/94
D[redacted]romomethane	ug/L	1200	ND		05/13/94
2-Chloroethylvinyl ether (mixed)	ug/L	1200	ND		05/13/94
E[redacted]hylmethacrylate	ug/L	1200	ND		05/13/94
1[redacted],3-Trichloropropane	ug/L	1200	ND		05/13/94
1,4-Dichloro-2-butene	ug/L	1200	ND		05/13/94
1[redacted]-Dichlorobenzene	ug/L	1200	ND		05/13/94
1[redacted]-Dichlorobenzene	ug/L	1200	ND		05/13/94
1,2-Dichlorobenzene	ug/L	1200	ND		05/13/94
1[redacted]-Dichloroethane-d4 (Surrogate)	%		93		05/13/94
T[redacted]uene-d8 (Surrogate)	%		106		05/13/94
4-Bromofluorobenzene (Surrogate)	%		92		05/13/94
P[redacted]TICIDES/PCBS				8080/608	
Aroclor 1016	ug/L	1.0	ND		05/13/94
A[redacted]clor 1221	ug/L	2.0	ND		05/13/94
A[redacted]clor 1232	ug/L	1.0	ND		05/13/94
Aroclor 1242	ug/L	1.0	ND		05/13/94
Aroclor 1248	ug/L	1.0	ND		05/13/94
A[redacted]clor 1254	ug/L	1.0	ND		05/13/94
Aroclor 1260	ug/L	1.0	1.08		05/13/94
ecachlorobiphenyl Surrogate	%		168 (1)		05/13/94
etrachloro-meta-xylene Surrogate	%		77		05/13/94
ibutylchlorendate (Surrogate)	%		87		05/13/94
esticides Prep			05/11/94		

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 26

FOOTNOTES
for pages 1 through 25

May 16, 1994
PACE Project Number: 54051051

Client Reference: Well Sampling

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
(1)	The Surrogate recovery value exceeded the established laboratory control limit value.
(2)	Compound concentration exceeds the calibration range of the instrument.

QUALITY
CONTROL

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 27

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

ESTICIDES/PCBS
Batch: 60 31803
amples: 60 0067996, 60 0068003, 60 0068011, 60 0068020, 60 0068046
60 0068054, 60 0068062, 60 0068070, 60 0068089, 60 0068097

ETHOD BLANK:

Parameter	Units	MDL	Method Blank
roclor 1016	ug/L	1.0	ND
roclor 1221	ug/L	2.0	ND
Aroclor 1232	ug/L	1.0	ND
Aroclor 1242	ug/L	1.0	ND
roclor 1248	ug/L	1.0	ND
roclor 1254	ug/L	1.0	ND
roclor 1260	ug/L	1.0	ND
ecachlorobiphenyl Surrogate	%		185 (1)
Tetrachloro-meta-xylene Surrogate	%		107
Dibutylchlorendate (Surrogate)	%		78

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RF
Aroclor 1242	ug/L	1.0	5.0	92%	104%	1
Aroclor 1260	ug/L	1.0	5.0	99%	96%	

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 28

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

PESTICIDES/PCBS
Batch: 60 31810
Samples: 60 0068038

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Aroclor 1016	ug/L	1.0	ND
Aroclor 1221	ug/L	2.0	ND
Aroclor 1232	ug/L	1.0	ND
Aroclor 1242	ug/L	1.0	ND
Aroclor 1248	ug/L	1.0	ND
Aroclor 1254	ug/L	1.0	ND
Aroclor 1260	ug/L	1.0	ND
Decachlorobiphenyl Surrogate	%		240 (1)
Tetrachloro-meta-xylene Surrogate	%		82
Dibutylchlorendate (Surrogate)	%		98

LABORATORY CONTROL SAMPLE AND CONTROL SAMPLE DUPLICATE:

Parameter	Units	MDL	Reference Value	Recv	Dupl Recv	RPD
Aroclor 1242	ug/L	1.0	5.0	92%	104%	12
Aroclor 1260	ug/L	1.0	5.0	99%	96%	3

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 29

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31784
Samples: 60 0068020

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Methyl chloride (Chloromethane)	ug/L	10	ND
Methyl bromide (Bromomethane)	ug/L	10	ND
Vinyl Chloride	ug/L	10	ND
Chloroethane	ug/L	10	ND
Methylene Chloride	ug/L	5	5
Acetone	ug/L	10	ND
Carbon Disulfide	ug/L	5	ND
1,1-Dichloroethylene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
1,2-Dichloroethylene (Total)	ug/L	5	ND
Chloroform	ug/L	5	ND
1,2-Dichloroethane	ug/L	5	ND
2-Butanone (MEK)	ug/L	5	ND
1,1,1-Trichloroethane	ug/L	5	ND
Carbon Tetrachloride	ug/L	5	ND
Vinyl Acetate	ug/L	5	ND
Dichlorobromomethane	ug/L	5	ND
1,2-Dichloropropane	ug/L	5	ND
Cis-1,3-Dichloropropene	ug/L	5	ND
Trichloroethylene	ug/L	5	ND
Chlorodibromomethane	ug/L	5	ND
1,1,2-Trichloroethane	ug/L	5	ND
Benzene	ug/L	5	ND
Trans-1,3-Dichloropropene	ug/L	5	ND
Bromoform	ug/L	5	ND
4-Methyl-2-Pentanone (MIBK)	ug/L	5	23
2-Hexanone	ug/L	5	ND
Tetrachloroethylene	ug/L	5	ND
1,1,2,2-Tetrachloroethane	ug/L	5	ND
Toluene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND
Ethylbenzene	ug/L	5	ND

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AY-17-94 TUE 06:50 PACE, INC FAX NO. 9135991759 P.28

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 30

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31784
amples: 60 0068020

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Styrene	ug/L	5	ND
ylenes (Total)	ug/L	5	ND
ichlorodifluoromethane	ug/L	10	ND
Trichlorofluoromethane	ug/L	5	ND
Acrolein	ug/L	100	ND
crylonitrile	ug/L	100	ND
Iodomethane	ug/L	5	ND
ibromomethane	ug/L	5	ND
-Chloroethylvinyl ether (mixed)	ug/L	5	ND
Ethylmethacrylate	ug/L	5	ND
1,2,3-Trichloropropane	ug/L	5	ND
,4-Dichloro-2-butene	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
,4-Dichlorobenzene	ug/L	5	ND
,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrogate)	%		94
Toluene-d8 (Surrogate)	%		97
-Bromofluorobenzene (Surrogate)	%		99

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	600068020 PZ 4A	Spike	Spike Recv	Spike Dupl Recv	RP
1-Dichloroethylene	ug/L	5	ND	50.00	53%	48%	10
					(2)	(3)	
Trichloroethylene	ug/L	5	88	50.00	112%	108%	4
Benzene	ug/L	5	ND	50.00	96%	93%	3
luene	ug/L	5	ND	50.00	108%	104%	4
lorobenzene	ug/L	5	ND	50.00	113%	109%	4

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REPORT OF LABORATORY ANALYSIS

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 54051051

r. Mark Liggatt
Page 31

lient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31784
amples: 60 0068020

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Methyl chloride (Chloromethane)	ug/L	10	50	152%
Methyl bromide (Bromomethane)	ug/L	10	50	110%
Vinyl Chloride	ug/L	10	50	125%
Chloroethane	ug/L	10	50	110%
Methylene Chloride	ug/L	5	50	109%
Acetone	ug/L	10	50	81%
Carbon Disulfide	ug/L	5	50	173%
1,1-Dichloroethylene	ug/L	5	50	121%
1,1-Dichloroethane	ug/L	5	50	100%
1,2-Dichloroethylene (Total)	ug/L	5	100	112%
Chloroform	ug/L	5	50	102%
1,2-Dichloroethane	ug/L	5	50	108%
2-Butanone (MEK)	ug/L	5	50	28%
1,1,1-Trichloroethane	ug/L	5	50	104%
Carbon Tetrachloride	ug/L	5	50	101%
Dichlorobromomethane	ug/L	5	50	103%
1,2-Dichloropropane	ug/L	5	50	102%
Cis-1,3-Dichloropropene	ug/L	5	50	101%
Trichloroethylene	ug/L	5	50	100%
Chlorodibromomethane	ug/L	5	50	98%
1,1,2-Trichloroethane	ug/L	5	50	99%
Benzene	ug/L	5	50	105%
Trans-1,3-Dichloropropene	ug/L	5	50	100%
Bromoform	ug/L	5	50	101%
4-Methyl-2-Pentanone (MIBK)	ug/L	5	50	36%
Tetrachloroethylene	ug/L	5	50	98%
1,1,2,2-Tetrachloroethane	ug/L	5	50	96%
Toluene	ug/L	5	50	100%
Chlorobenzene	ug/L	5	50	98%
Ethylbenzene	ug/L	5	50	98%
Styrene	ug/L	5	50	102%
Xylenes (Total)	ug/L	5	150	97%

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REPORT OF LABORATORY ANALYSIS

. Mark Liggatt
Page 32

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 54051051

ient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31792
mples: 60 0067996, 60 0068003, 60 0068011, 60 0068054, 60 0068089
60 0068097

THOD BLANK:

Parameter	Units	MDL	Method Blank
ethyl chloride (Chloromethane)	ug/L	10	ND
ethyl bromide (Bromomethane)	ug/L	10	ND
Vinyl Chloride	ug/L	10	ND
hloroethane	ug/L	10	ND
ethylene Chloride	ug/L	5	ND
Acetone	ug/L	10	ND
arbon Disulfide	ug/L	5	ND
,1-Dichloroethylene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
,2-Dichloroethylene (Total)	ug/L	5	ND
hloroform	ug/L	5	ND
,2-Dichloroethane	ug/L	5	ND
-Butanone (MEK)	ug/L	5	ND
,1,1-Trichloroethane	ug/L	5	ND
Carbon Tetrachloride	ug/L	5	ND
inyl Acetate	ug/L	5	ND
ichlorobromomethane	ug/L	5	ND
,2-Dichloropropane	ug/L	5	ND
is-1,3-Dichloropropene	ug/L	5	ND
richloroethylene	ug/L	5	ND
Chlorodibromomethane	ug/L	5	ND
,1,2-Trichloroethane	ug/L	5	ND
enzene	ug/L	5	ND
rans-1,3-Dichloropropene	ug/L	5	ND
romoform	ug/L	5	ND
-Methyl-2-Pentanone (MIBK)	ug/L	5	17
2-Hexanone	ug/L	5	ND
Tetrachloroethylene	ug/L	5	ND
,1,2,2-Tetrachloroethane	ug/L	5	ND
oluene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND

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REPORT OF LABORATORY ANALYSIS

. Mark Liggatt
Page 33

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 54051051

ient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31792
amples: 60 0067996, 60 0068003, 60 0068011, 60 0068054, 60 0068089
60 0068097

ETHOD BLANK:

Parameter	Units	MDL	Method Blank
thylbenzene	ug/L	5	ND
tyrene	ug/L	5	ND
Xylenes (Total)	ug/L	5	ND
ichlorodifluoromethane	ug/L	10	ND
richlorofluoromethane	ug/L	5	ND
Acrolein	ug/L	100	ND
crylonitrile	ug/L	100	ND
odomethane	ug/L	5	ND
Dibromomethane	ug/L	5	ND
2-Chloroethylvinyl ether (mixed)	ug/L	5	ND
Ethylmethacrylate	ug/L	5	ND
1,2,3-Trichloropropane	ug/L	5	ND
1,4-Dichloro-2-butene	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
1,4-Dichlorobenzene	ug/L	5	ND
1,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrogate)	%		101
Toluene-d8 (Surrogate)	%		101
4-Bromofluorobenzene (Surrogate)	%		100

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MOL	600068020 PZ 4A	Spike	Spike Recv	Spike Dupl Recv
1,1-Dichloroethylene	ug/L	5	ND	50.00	53% (4)	48% (5)
Trichloroethylene	ug/L	5	88	50.00	112%	108%
Benzene	ug/L	5	ND	50.00	96%	93%
Toluene	ug/L	5	ND	50.00	108%	104%
Chlorobenzene	ug/L	5	ND	50.00	113%	109%

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 39

FOOTNOTES
for pages 27 through 38

May 16, 1994
PACE Project Number: 54051051?

Client Reference: Well Sampling

MDL	Method Detection Limit
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference
(1)	The Surrogate recovery value exceeded the established laboratory control limit value.
(2)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.
(3)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.
(4)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.
(5)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.
(6)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.
(7)	The percent recovery for 1,1-Dichloroethene is below the laboratory control established control limit.

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 38

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

lient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31795
amples: 60 0068038, 60 0068046, 60 0068062, 60 0068070, 60 0068100

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Methyl chloride (Chloromethane)	ug/L	10	50	152%
ethyl bromide (Bromomethane)	ug/L	10	50	110%
inyl Chloride	ug/L	10	50	125%
Chloroethane	ug/L	10	50	110%
ethylene Chloride	ug/L	5	50	109%
cetone	ug/L	10	50	81%
Carbon Disulfide	ug/L	5	50	173%
,1-Dichloroethylene	ug/L	5	50	121%
,1-Dichloroethane	ug/L	5	50	100%
1,2-Dichloroethylene (Total)	ug/L	5	100	112%
Chloroform	ug/L	5	50	102%
,2-Dichloroethane	ug/L	5	50	108%
2-Butanone (MEK)	ug/L	5	50	28%
,1,1-Trichloroethane	ug/L	5	50	104%
arbon Tetrachloride	ug/L	5	50	101%
Dichlorobromomethane	ug/L	5	50	103%
,2-Dichloropropane	ug/L	5	50	102%
is-1,3-Dichloropropene	ug/L	5	50	101%
Trichloroethylene	ug/L	5	50	100%
hlorodibromomethane	ug/L	5	50	98%
,1,2-Trichloroethane	ug/L	5	50	99%
Benzene	ug/L	5	50	105%
Trans-1,3-Dichloropropene	ug/L	5	50	100%
romoform	ug/L	5	50	101%
4-Methyl-2-Pentanone (MIBK)	ug/L	5	50	36%
etrachloroethylene	ug/L	5	50	98%
,1,2,2-Tetrachloroethane	ug/L	5	50	96%
Toluene	ug/L	5	50	100%
Chlorobenzene	ug/L	5	50	98%
thylbenzene	ug/L	5	50	98%
Styrene	ug/L	5	50	102%
ylenes (Total)	ug/L	5	150	97%

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 37

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31795
Samples: 60 0068038, 60 0068046, 60 0068062, 60 0068070, 60 0068100

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Styrene	ug/L	5	ND
Xylenes (Total)	ug/L	5	ND
Dichlorodifluoromethane	ug/L	10	ND
Trichlorofluoromethane	ug/L	5	ND
Acrolein	ug/L	100	ND
Acrylonitrile	ug/L	100	ND
Iodomethane	ug/L	5	ND
Dibromomethane	ug/L	5	ND
2-Chloroethylvinyl ether (mixed)	ug/L	5	ND
Ethylmethacrylate	ug/L	5	ND
1,2,3-Trichloropropane	ug/L	5	ND
1,4-Dichloro-2-butene	ug/L	5	ND
1,3-Dichlorobenzene	ug/L	5	ND
1,4-Dichlorobenzene	ug/L	5	ND
1,2-Dichlorobenzene	ug/L	5	ND
1,2-Dichloroethane-d4 (Surrogate)	%		103
Toluene-d8 (Surrogate)	%		101
4-Bromofluorobenzene (Surrogate)	%		100

SPIKE AND SPIKE DUPLICATE:

Parameter	Units	MDL	600068020 PZ 4A	Spike	Spike Recv	Spike Dupl Recv	F
1,1-Dichloroethylene	ug/L	5	ND	50.00	53% (6)	48% (7)	I
Trichloroethylene	ug/L	5	88	50.00	112%	108%	
Benzene	ug/L	5	ND	50.00	96%	93%	
Toluene	ug/L	5	ND	50.00	108%	104%	
Chlorobenzene	ug/L	5	ND	50.00	113%	109%	

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REPORT OF LABORATORY ANALYSIS

Mr. Mark Liggatt
Page 34

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

Client Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31792
Samples: 60 0067996, 60 0068003, 60 0068011, 60 0068054, 60 0068089
60 0068097

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Methyl chloride (Chloromethane)	ug/L	10	50	152%
Methyl bromide (Bromomethane)	ug/L	10	50	110%
Vinyl Chloride	ug/L	10	50	125%
Chloroethane	ug/L	10	50	110%
Methylene Chloride	ug/L	5	50	109%
Acetone	ug/L	10	50	81%
Carbon Disulfide	ug/L	5	50	173%
1,1-Dichloroethylene	ug/L	5	50	121%
1,1-Dichloroethane	ug/L	5	50	100%
1,2-Dichloroethylene (Total)	ug/L	5	100	112%
Chloroform	ug/L	5	50	102%
1,2-Dichloroethane	ug/L	5	50	108%
2-Butanone (MEK)	ug/L	5	50	28%
1,1,1-Trichloroethane	ug/L	5	50	104%
Carbon Tetrachloride	ug/L	5	50	101%
Dichlorobromomethane	ug/L	5	50	103%
1,2-Dichloropropane	ug/L	5	50	102%
Cis-1,3-Dichloropropene	ug/L	5	50	101%
Trichloroethylene	ug/L	5	50	100%
Chlorodibromomethane	ug/L	5	50	98%
1,1,2-Trichloroethane	ug/L	5	50	99%
Benzene	ug/L	5	50	105%
Trans-1,3-Dichloropropene	ug/L	5	50	100%
Bromoform	ug/L	5	50	101%
4-Methyl-2-Pentanone (MIBK)	ug/L	5	50	36%
Tetrachloroethylene	ug/L	5	50	98%
1,1,2,2-Tetrachloroethane	ug/L	5	50	96%
Toluene	ug/L	5	50	100%
Chlorobenzene	ug/L	5	50	98%
Ethylbenzene	ug/L	5	50	98%
Styrene	ug/L	5	50	102%

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
Page 35

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

lient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31792
Samples: 60 0067996, 60 0068003, 60 0068011, 60 0068054, 60 0068089
60 0068097

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recv
Xylenes (Total)	ug/L	5	150	97%

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REPORT OF LABORATORY ANALYSIS

r. Mark Liggatt
age 36

QUALITY CONTROL DATA

May 16, 1994
PACE Project Number: 5405105

lient Reference: Well Sampling

VOLATILE ORGANICS
Batch: 60 31795
amples: 60 0068038, 60 0068046, 60 0068062, 60 0068070, 60 0068100

METHOD BLANK:

Parameter	Units	MDL	Method Blank
Methyl chloride (Chloromethane)	ug/L	10	ND
Methyl bromide (Bromomethane)	ug/L	10	ND
Vinyl Chloride	ug/L	10	ND
Chloroethane	ug/L	10	ND
Methylene Chloride	ug/L	5	ND
Acetone	ug/L	10	10
Carbon Disulfide	ug/L	5	ND
1,1-Dichloroethylene	ug/L	5	ND
1,1-Dichloroethane	ug/L	5	ND
1,2-Dichloroethylene (Total)	ug/L	5	ND
Chloroform	ug/L	5	ND
1,2-Dichloroethane	ug/L	5	ND
2-Butanone (MEK)	ug/L	5	ND
1,1,1-Trichloroethane	ug/L	5	ND
Carbon Tetrachloride	ug/L	5	ND
Vinyl Acetate	ug/L	5	ND
Dichlorobromomethane	ug/L	5	ND
1,2-Dichloropropane	ug/L	5	ND
Cis-1,3-Dichloropropene	ug/L	5	ND
Trichloroethylene	ug/L	5	ND
Chlorodibromomethane	ug/L	5	ND
1,1,2-Trichloroethane	ug/L	5	ND
Benzene	ug/L	5	ND
Trans-1,3-Dichloropropene	ug/L	5	ND
Bromoform	ug/L	5	ND
4-Methyl-2-Pentanone (MIBK)	ug/L	5	ND
2-Hexanone	ug/L	5	ND
Tetrachloroethylene	ug/L	5	ND
1,1,2,2-Tetrachloroethane	ug/L	5	ND
Toluene	ug/L	5	ND
Chlorobenzene	ug/L	5	ND
Ethylbenzene	ug/L	5	ND

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REPORT OF LABORATORY ANALYSIS

M[redacted] Mark Liggatt
P[redacted]ge 24

May 16, 1994
PACE Project Number: 540510512

Client Reference: Well Sampling

P[redacted]CE Sample Number: 60 0068100
Date Collected: 05/10/94
Date Received: 05/10/94
C[redacted]ient Sample ID: Trip Blank

P[redacted]rameter	Units	MDL	Trip Blank	METHOD	DATE ANALYZED
O[redacted]GANIC ANALYSIS					
V[redacted]LATILE ORGANICS				8240	
Methyl chloride (Chloromethane)	ug/L	10	ND		05/14/94
M[redacted]thyl bromide (Bromomethane)	ug/L	10	ND		05/14/94
V[redacted]yl Chloride	ug/L	10	ND		05/14/94
Chloroethane	ug/L	10	ND		05/14/94
Methylene Chloride	ug/L	5	ND		05/14/94
A[redacted]tone	ug/L	10	ND		05/14/94
Carbon Disulfide	ug/L	5	ND		05/14/94
1,1-Dichloroethylene	ug/L	5	ND		05/14/94
1[redacted]-Dichloroethane	ug/L	5	ND		05/14/94
1,2-Dichloroethylene (Total)	ug/L	5	ND		05/14/94
Chloroform	ug/L	5	ND		05/14/94
1[redacted]2-Dichloroethane	ug/L	5	ND		05/14/94
2-Butanone (MEK)	ug/L	5	ND		05/14/94
1,1,1-Trichloroethane	ug/L	5	ND		05/14/94
C[redacted]rbon Tetrachloride	ug/L	5	ND		05/14/94
V[redacted]yl Acetate	ug/L	5	ND		05/14/94
Dichlorobromomethane	ug/L	5	ND		05/14/94
1,2-Dichloropropane	ug/L	5	ND		05/14/94
C[redacted]-1,3-Dichloropropene	ug/L	5	ND		05/14/94
Trichloroethylene	ug/L	5	ND		05/14/94
Ch[redacted]orodibromomethane	ug/L	5	ND		05/14/94
1[redacted],2-Trichloroethane	ug/L	5	ND		05/14/94
B[redacted]nzene	ug/L	5	ND		05/14/94
Trans-1,3-Dichloropropene	ug/L	5	ND		05/14/94
B[redacted]moform	ug/L	5	ND		05/14/94
4-Methyl-2-Pentanone (MIBK)	ug/L	5	23		05/14/94
2-Hexanone	ug/L	5	ND		05/14/94
T[redacted]rachloroethylene	ug/L	5	ND		05/14/94
1[redacted],2,2-Tetrachloroethane	ug/L	5	ND		05/14/94
Toluene	ug/L	5	ND		05/14/94
C[redacted]orobenzene	ug/L	5	ND		05/14/94

anager, Organic Chemistry

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REPORT OF LABORATORY ANALYSIS

Ir[redacted] Mark Liggatt
'a[redacted]e 25

May 16, 1994
PACE Project Number: 540510512

:lient Reference: Well Sampling

'A[redacted] Sample Number:)ate Collected:)a[redacted]e Received: :l[redacted]ent Sample ID: 'a[redacted]ameter	Units	MDL	60 0068100 05/10/94 05/10/94 Trip Blank	METHOD	DATE ANALYZED
)R[redacted]ANIC ANALYSIS					
/OLATILE ORGANICS				8240	
E[redacted]ylbenzene	ug/L	5	ND		05/14/94
St[redacted]rene	ug/L	5	ND		05/14/94
(y[redacted]enes (Total)	ug/L	5	ND		05/14/94
)ichlorodifluoromethane	ug/L	10	ND		05/14/94
Tr[redacted]chlorofluoromethane	ug/L	5	ND		05/14/94
Ac[redacted]olein	ug/L	100	ND		05/14/94
Ac[redacted]ylonitrile	ug/L	100	ND		05/14/94
I[redacted]omethane	ug/L	5	ND		05/14/94
)i[redacted]romomethane	ug/L	5	ND		05/14/94
2-Chloroethylvinyl ether (mixed)	ug/L	5	ND		05/14/94
E[redacted]ylmethacrylate	ug/L	5	ND		05/14/94
1[redacted],3-Trichloropropane	ug/L	5	ND		05/14/94
1,[redacted]-Dichloro-2-butene	ug/L	5	ND		05/14/94
1[redacted]-Dichlorobenzene	ug/L	5	ND		05/14/94
1,[redacted]-Dichlorobenzene	ug/L	5	ND		05/14/94
1,2-Dichlorobenzene	ug/L	5	ND		05/14/94
1[redacted]-Dichloroethane-d4 (Surrogate)	%		106		05/14/94
To[redacted]uene-d8 (Surrogate)	%		102		05/14/94
4-Bromofluorobenzene (Surrogate)	%		102		05/14/94

These data have been reviewed and are approved for release.

D.R. Bolinger for
N[redacted]l R. Hudson
M[redacted]ager, Organic Chemistry

APPENDIX D

MATERIAL SAFETY DATA SHEET

UNISON TRANSFORMER SERVICES, INC.
1338 Hundred Oaks Drive
Charlotte, NC 28217
1 800 544-0030

EFFECTIVE DATE: October 15, 1987

POD MSDS 811-1

IMPORTANT: UNISON urges each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the material. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology or fire prevention, as necessary or appropriate, to use and understand the data contained in this MSDS.

To Promote safe handling, it is recommended that each Customer notify its employees, agents, and contractors of the information on this Material Safety Data Sheet.

I. IDENTIFICATION

PRODUCT NAME:	MO-X-PCB
CHEMICAL NAME:	Light naphthenic distillate, petroleum, with PCB
CHEMICAL FAMILY:	Petroleum Electrical Insulating Oil with PCB
FORMULA:	Mixture
MOLECULAR WEIGHT:	Mixture
SYNONYMS:	Mineral Oil which contains PCBs

II. PHYSICAL DATA (Determined on typical material)

BOILING POINT, 760 mm Hg:	CA 250 Deg. C
SPECIFIC GRAVITY (H_2O =1):	0.87 at 25/25 Deg. C
FREEZING POINT:	Less than -45 Deg. C
VAPOR PRESSURE AT 20 Deg. C:	Less than 1 mm Hg
VAPOR DENSITY (air = 1):	Greater than 1
EVAPORATION RATE (Butyl Acetate = 1):	Less than 1
SOLUBILITY IN WATER % by wt:	Insoluble
APPEARANCE AND ODOR:	Clear, nearly colorless liquid, aromatic odor

III. INGREDIENTS

MATERIALS	Concentration	TLV UNITS
Mineral Oil CAS NO: 64742-53-6,64742-45-6, 64741-96-4, or 64742-52-5	Approx. 98.5-99.5 %	See Section V
2,6-di-tertiary-butyl-para-cresol CAS NO: 128-37-0	Approx. 0.5 %	None Established
Polychlorinated Biphenyls CAS NO: 1336-36-3	Approx. 50-10000 ppm	See Section V

IV. FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (test method): Greater than 293 Deg. F (Cleveland open cup ASTM D 92).

FLAMMABLE LIMITS IN AIR, by volume: LOWER 0.9 estimated
UPPER 7.0 estimated

EXTINGUISHING MEDIA: Use water spray, carbon dioxide, dry chemical, alcohol-type or universal-type foams applied by manufacturer's recommended technique.

SPECIAL FIRE FIGHTING PROCEDURES: Wear self-contained breathing apparatus and standard fire-fighter wearing apparel: toxic and irritating vapors can be evolved. Do not spray a solid stream of water or foam directly into a pool of hot burning liquid as this may cause frothing and may intensify the fire.

(FIRE AND EXPLOSION HAZARD DATA continued on next page)

UNUSUAL FIRE AND EXPLOSION HAZARDS: In extreme fire conditions, this material may present a floating fire hazard. See Section VI for products of combustion.

V. HEALTH HAZARD DATA

TLV (SOURCE): PCBs 42% chlorine, 8-hr TWA 1.0 mg/m3 - Skin * (ACGIH)
2 mg/m3 short-term exposure limit - Skin * (ACGIH)
54% chlorine, 8 hr TWA 0.5 mg/m3 - Skin* (ACGIH)
1mg/m3 short term exposure limit - Skin (ACGIH)

Oil Mist,
Mineral 8 hr TWA 5.0 mg/m3 (ACGIH), STEL 10 mg/m3.

* Skin absorption may add to the overall exposure. Avoid skin contact.

EFFECTS OF SINGLE OVEREXPOSURE:

SWALLOWING: Moderate toxicity, irritating to throat, may cause lethargy, nausea, vomiting, and diarrhea. Aspiration of light hydrocarbon or subsequent vomiting may cause pneumonitis.

SKIN ABSORPTION: Moderately toxic. Prolonged or widespread contact may result in the absorption of potentially harmful amounts of material.

INHALATION: Mists or vapors from heated material are irritating to nose, throat and lungs.

SKIN CONTACT: Brief contact causes minimal irritation.

EYE CONTACT: Liquid or vapor may cause minor irritation, depending on the concentration of vapor and duration of exposure.

EFFECTS OF REPEATED OVEREXPOSURE: Liver injury, chloracne, skin lesions, skin sensitization. Laboratory studies have shown Polychlorinated Biphenyls to be an animal carcinogen.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Persons who are prone to acne or seborrhea are susceptible to blockage of hair follicles by insoluble oils. Folliculitis may develop. Comedones and perifollicular papules and pustules (oil boils) may occur. These effects should rapidly clear upon cessation of exposure. Good housekeeping and personal hygiene should prevent these effects.

(HEALTH HAZARD DATA continued on next page)

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: PCBs have been identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monograph (1982) 'Group 2B' and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Third).

Several studies report a wide spectrum of immunotoxic effects of PCBs on rats and mice, including thymic, lymph node and splenic atrophy, suppression of antibody responses, decreased resistance to infections, depression of T-cell responsiveness to mitogens and suppression of delayed hypersensitivity.

OTHER EFFECTS OF OVEREXPOSURE: PCBs are readily absorbed into the body by all routes of exposure. They are stored in fatty tissues from which they are slowly released into the blood stream. Laboratory studies show the material to be embryotoxic and fetotoxic.

EMERGENCY AND FIRST AID PROCEDURES

SWALLOWING: Do not induce vomiting. Seek prompt medical attention.

SKIN: Remove contaminated clothing and wipe excess material from skin. Wash skin thoroughly with soap and water.

INHALATION: Remove to fresh air. Give artificial respiration if not breathing. Oxygen may be given if breathing is difficult. Call a physician.

EYES: Flush eyes thoroughly with water for a least 15 minutes. Seek medical attention if discomfort persists.

NOTES TO PHYSICIAN: There is no specific antidote. Treatment of overexposure should be directed to the control of symptoms and the clinical condition.

VI. REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: Avoid high temperatures over 550 Deg. F.

INCOMPATIBILITY (MATERIALS TO AVOID): Oxidizing agents.

(REACTIVITY DATA continued on next page)

HAZARDOUS COMBUSTION OR
DECOMPOSITION PRODUCTS: Contact with an open flame or an electric arc can generate carbon monoxide, carbon dioxide, and hydrogen chloride. Dioxins and furans may be produced if exposed to high temperature conditions.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: None

VII. SPILL OR LEAKS PROCEDURES

STEPS TO BE TAKEN IF MATERIAL
IS RELEASED OR SPILLED: Nofify UNISON immediately. Collect spills with absorbent solids or contain and pump to drums for disposal. If frozen, shovel into drums.

WASTE DISPOSAL METHOD: Contains PCBs. Incinerate in facilities designed to handle halogenated emissions gases, and approved for PCB waste which are operated in accordance with Federal, State, and Local regulations.

VIII. SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION: Full face or half face respirator with organic canister.

VENTILATION: General (mechanical) room ventilation is expected to be satisfactory. Use local exhaust to capture vapor, mists or fumes, if necessary. Provide greater than 60 feet per minute hood face velocity for confined spaces. Provide ventilation sufficient to prevent exceeding recommended exposure limit or buildup of explosive concentrations of vapor in air. Use explosion-proof equipment. No smoking or open lights.

PROTECTIVE GLOVES: Gloves - Approved Viton, milled nitrile or milled neoprene
Other - Approved Saranex laminated Tyvek clothing as appropriate.

EYE PROTECTION: Monogoggles.

OTHER PROTECTIVE EQUIPMENT: Shower, eye bath, chemical resistant apron and boots.

IX. SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

WARNING! CAUSES EYE AND SKIN IRRITATION.
HARMFUL IF INHALED.
HARMFUL IF SWALLOWED.
HARMFUL IF ABSORBED THROUGH SKIN.
CAUSES CANCER IN LABORATORY ANIMALS.

Do not swallow.
Avoid breathing vapor.
Avoid contact with eyes, skin, and clothing.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

- FOR INDUSTRY USE ONLY -

OTHER PRECAUTIONS: Avoid discharge to the environment.

NOTE: While UNISON believes that the data contained herein are factual and the opinions expressed are those of qualified experts regarding the results of the tests conducted, the data are not to be taken as a warranty or representation for which UNISON assumes legal responsibility. They are offered solely for your consideration, investigation, and verification. Any use of these data and information must be determined by the user to be in accordance with applicable Federal, State and local laws and regulations.

EMERGENCY PHONE NUMBER

1-800-UCC-HELP

THIS NUMBER IS AVAILABLE DAYS, NIGHTS, WEEKENDS AND HOLIDAYS

****

MATERIAL SAFETY DATA SHEET

Prepared by- FS REVISION MARCH 92
Date of Preparation- 04-08-92 For:
Manufacturer: CHEMICAL SOLVENTS, INC.
Address : 3751 Jennings Road
Cleveland, Ohio 44109

Telephone#: (216) 741-9310 Night: (216) 741-9310
Emergency#: (800) 424-9300(Chemtrec) National: (800) 362-0693

****

SECTION I PRODUCT IDENTIFICATION

Manufacturer's Code Identification: RPTRI
Product Class:
Trade Name: RECLAIMED TRICHLOROETHYLENE

HMIS Information: Health- 3 Flammability- 1
Reactivity- 0
HAZARD INDEX: 4= Severe 3= Serious 2= Moderate 1= Slight 0= Least

****

SECTION II HAZARDOUS INGREDIENTS

TRICHLOROETHYLENE
01 CAS# 79-01-6

EXPOSURE LIMIT:
OSHA TWA (final): 50 PPM
ACGIH TLV/TWA: 50 PPM
OSHA CEILING: 200 PPM

****

SECTION III PHYSICAL DATA

Boiling Range: High- 188.0 F Low- 188.0 F
Vapor Pressure: 58.00 MMHG @68 F
Vapor Density: Heavier Than Air
Evaporation Rate: Faster than Butyl Acetate
Weight per Gallon: 12.20
% Volatile by Weight: 100.00
Physical State: LIQUID
Appearance: CLEAR
Odor: SOLVENT
Odor Threshold: N/A
pH: N/A
Freezing Point: N/A
Water Solubility: SLIGHT
Coefficient of Water/Oil Distribution: N/A

CHEMICAL SOLVENTS, INC.

RPTRI MATERIAL SAFETY DATA SHEET

RECLAIMED TRICHLOROETHYLENE

SECTION IV FIRE AND EXPLOSION DATA

Flammability Classification: N/A DOT: N/A

EXTINGUISHING MEDIA

Use CO_2, dry chemical, foam, or water fog. Water may be helpful to cool containers.

UNUSUAL FIRE AND EXPLOSION HAZARD:

If this blend is flammable or combustible (flashpoint below 200), do not weld or cut on containers.

SECTION V HEALTH HAZARD & FIRST AID

FIRST AID:

INHALATION: Move victim to fresh air. If breathing has stopped administer artificial respiration. Seek medical attention.

SKIN: Remove contaminated clothing. Wash well with soap and water for at least 15 minutes. Launder contaminated clothing before wearing.

EYES: Flush eyes immediately with water for at least 15 minutes. If irritation persists seek medical attention.

INGESTION: Do not induce vomiting. Seek medical attention immediately.

HEALTH TOXICITY:

EYE CONTACT: May cause temporary irritation with temporary corneal injury.

INGESTION: Single dose toxicity is low to moderate. If vomiting occurs this product can be aspirated into the lungs, which can cause chemical pneumonia and systemic effects.

INHALATION: Major potential route of exposure. Minimal effects observed below 1,000 ppm, dizziness, drowsiness, and throat irritation at levels above 1,000 ppm. Unconsciousness and death possible at levels above 10,000 ppm.

SKIN CONTACT: Contact with this product may cause irritation, defatting, of the skin and dermatitis. Absorption through the skin is possible if contact is prolonged.

OVERALL HEALTH EFFECTS: This product has NOT been found to be a carcinogen or a potential carcinogen by the NTP, IARC or OSHA.

SECTION VI REACTIVITY DATA

STABILITY: Stable HAZARDOUS POLYMERIZATION: Will not occur.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydogen chloride, phosgene and chlorine

INCOMPATABILITIES: Strong oxidizers, barium, lithium, magnesium & titanium. Avoid aluminum in pressurized fluid systems.

CONDITIONS TO AVOID: Hot surfaces that could cause thermal decomposition.

CHEMICAL SOLVENTS, INC.

RPTRI MATERIAL SAFETY DATA SHEET

RECLAIMED TRICHLOROETHYLENE

SECTION VII EMERGENCY RESPONSE & DISPOSAL

DISPOSAL: Dispose of this product in accordance with local, state and federal regulations. Call CHEMICAL SOLVENTS, INC. for recycling or disposal.

The EMERGENCY RESPONSE GUIDEBOOK number is:
74

PRECAUTIONS IN CASE OF A SPILL OR RELEASE: Stop and contain spill if possible. Use trained personnel. Keep out of drains and waterways. Pump into drums and contact Chemical Solvents Inc. for disposal or recycling.

SECTION VIII PERSONAL PROTECTION EQUIPMENT

VENTILATION / RESPIRATORS:
Use ventilation as required to control vapors concentrations. Avoid prolonged or repeated breathing of vapors. If exposure exceeds TLV use a NIOSH approved respirator to prevent over exposure.
EYES: Wear splash goggles or a face shield when handling.
SKIN: Wear solvent resistant gloves such as Viton. Use solvent resistant boots, apron, and headgear if splashing is possible.

SECTION IX STORAGE & TRANSPORTATION

DOT SHIPPING CLASSIFICATION: (49CFR 172.101)
Trichloroethylene Solution, ORM-A UN 1710
HANDLING AND STORING PRECAUTIONS
Store labeled, sealed containers in a cool, dry, well ventilated area.

SECTION X Section 313 Toxic Chemicals

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and of 40 CFR 372:

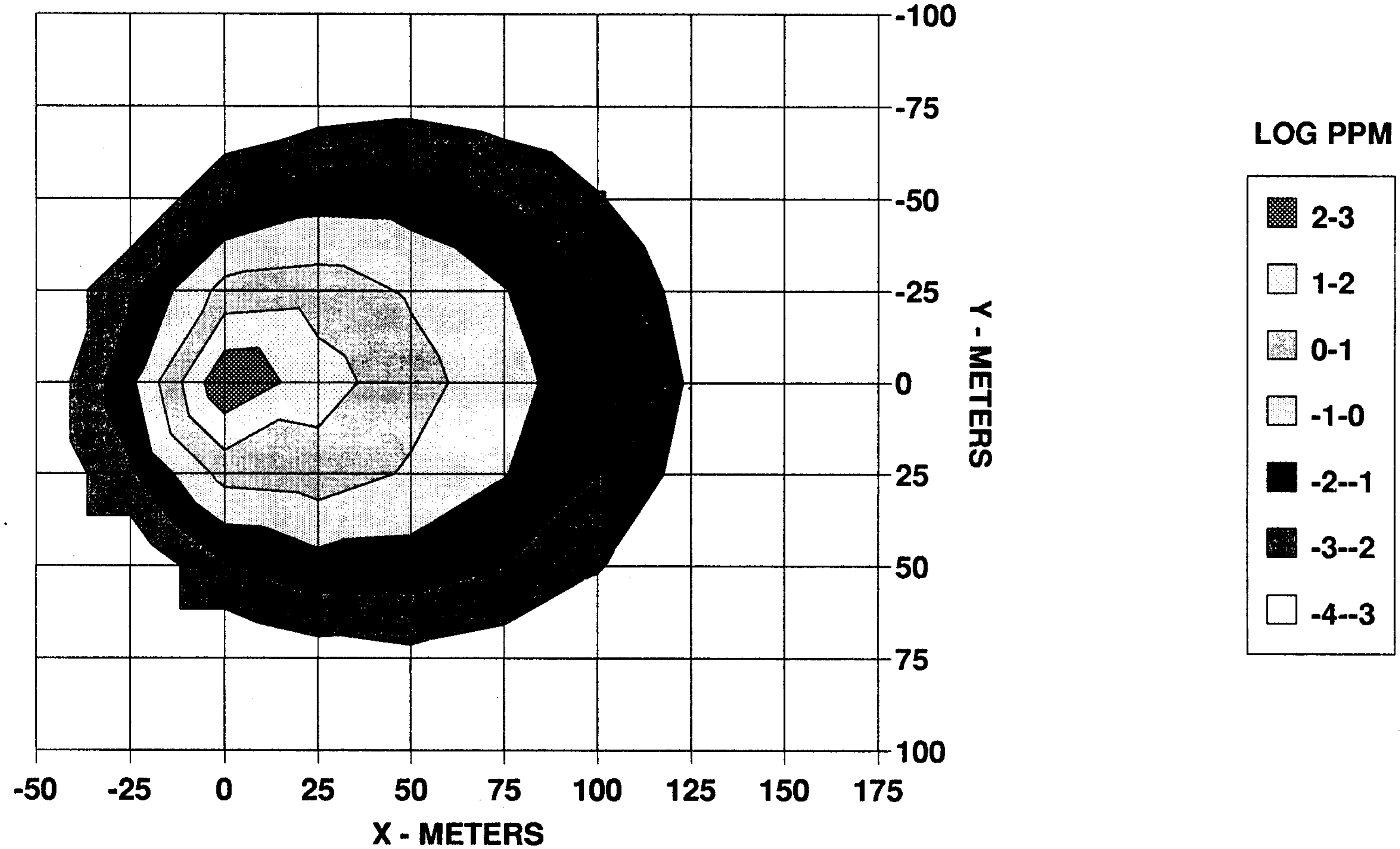
Chemical	CAS Number	Weight %
TRICHLOROETHYLENE	79-01-6	90 TO 100%

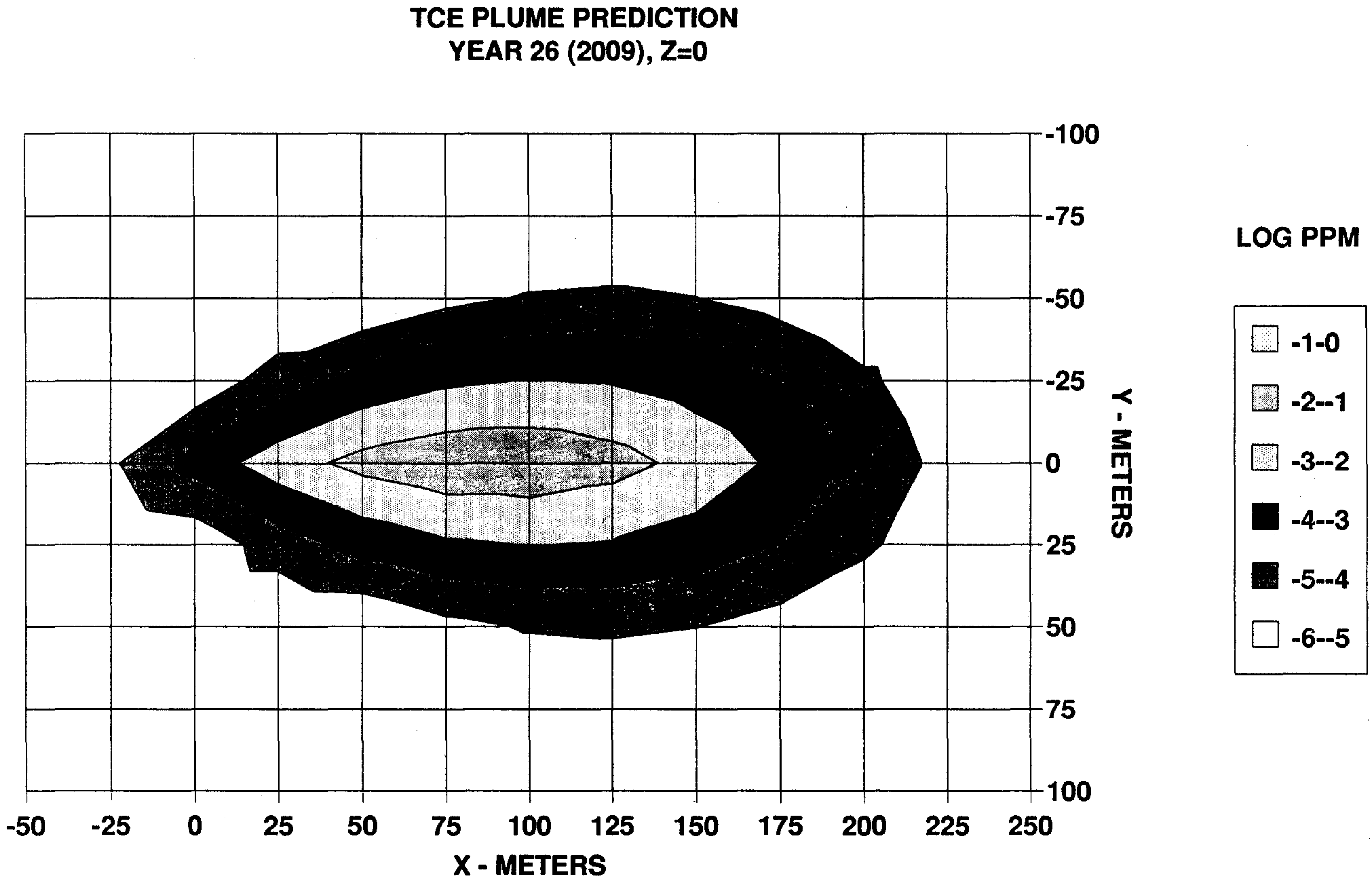
THE INFORMATION CONTAINED HEREIN IS INFORMATION RECEIVED FROM OUR RAW MATERIAL SUPPLIERS AND OTHER SOURCES AND IS BELIEVED TO BE RELIABLE. THIS DATA IS NOT TO BE TAKEN AS A WARRANTY OR REPRESENTATION FOR WHICH CHEMICAL SOLVENTS INC. ASSUMES LEGAL RESPONSIBILITY.

reviewed by FS_____ TM_____ JS_____

APPENDIX E

TCE PLUME PREDICTION
YEAR 11 (1994), Z=0




TCE PLUME PREDICTION
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-25
0
25
50
75
100
Y - METERS
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-25
0
25
50
75
100
125
150
175
200
225
250
X - METERS
LOG PPM
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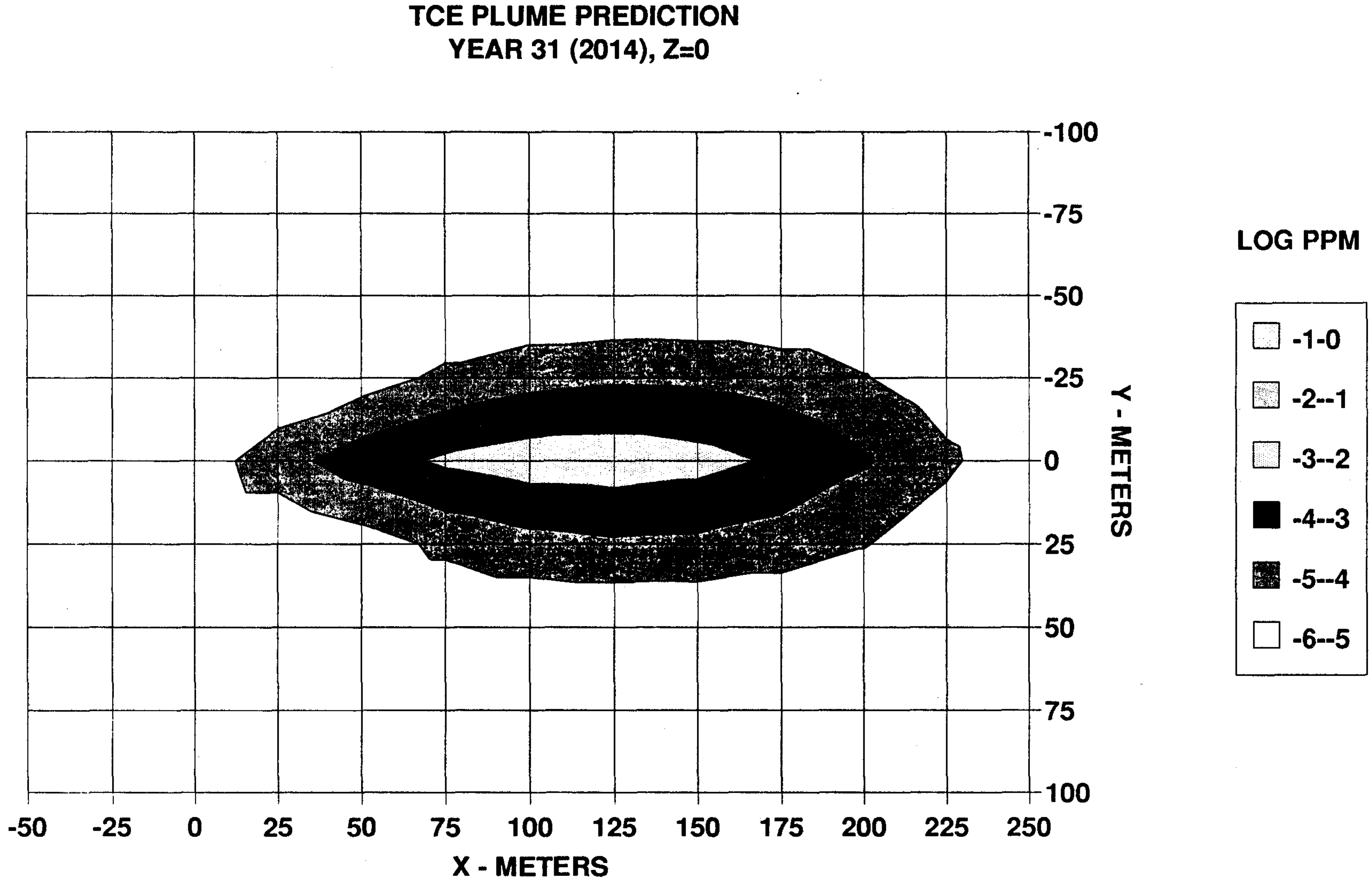
-2--1
-3--2
-4--3
-5--4
-6--5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-25
0
25
50
75
100
125
150
175
200
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X - METERS
LOG PPM
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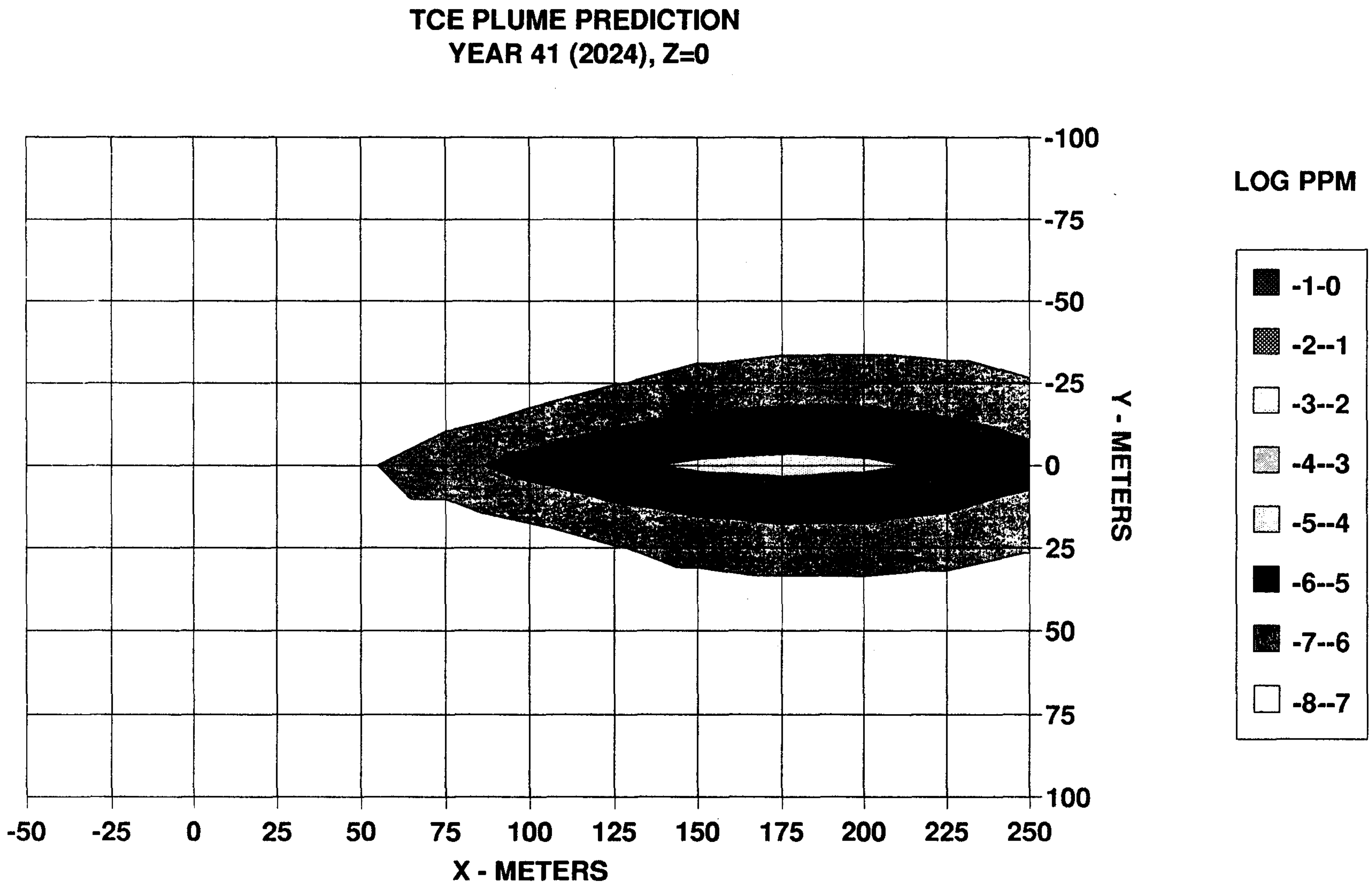
-3--2
-4--3
-5--4
-6--5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200
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X - METERS
LOG PPM
-1-0
-2--1
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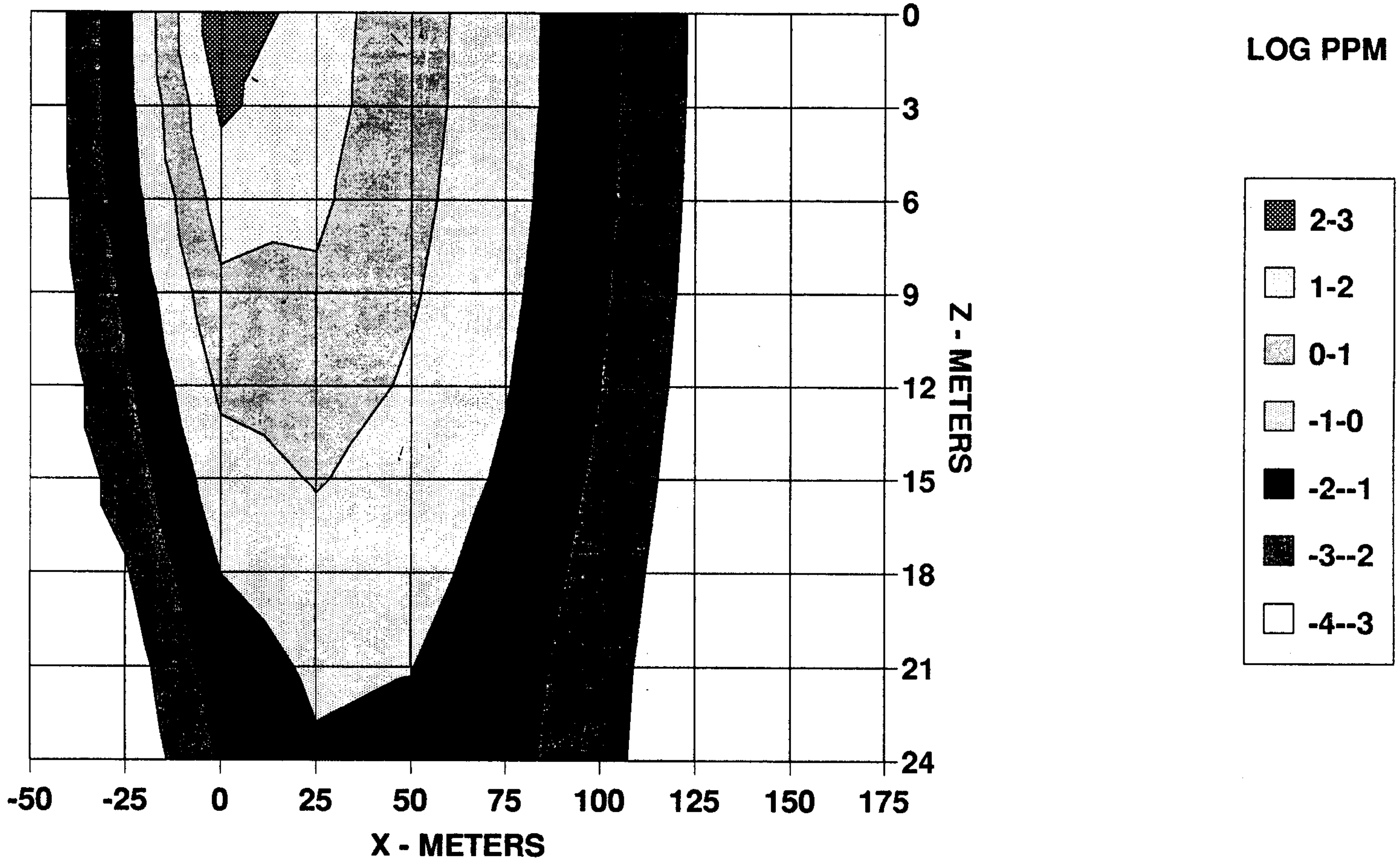
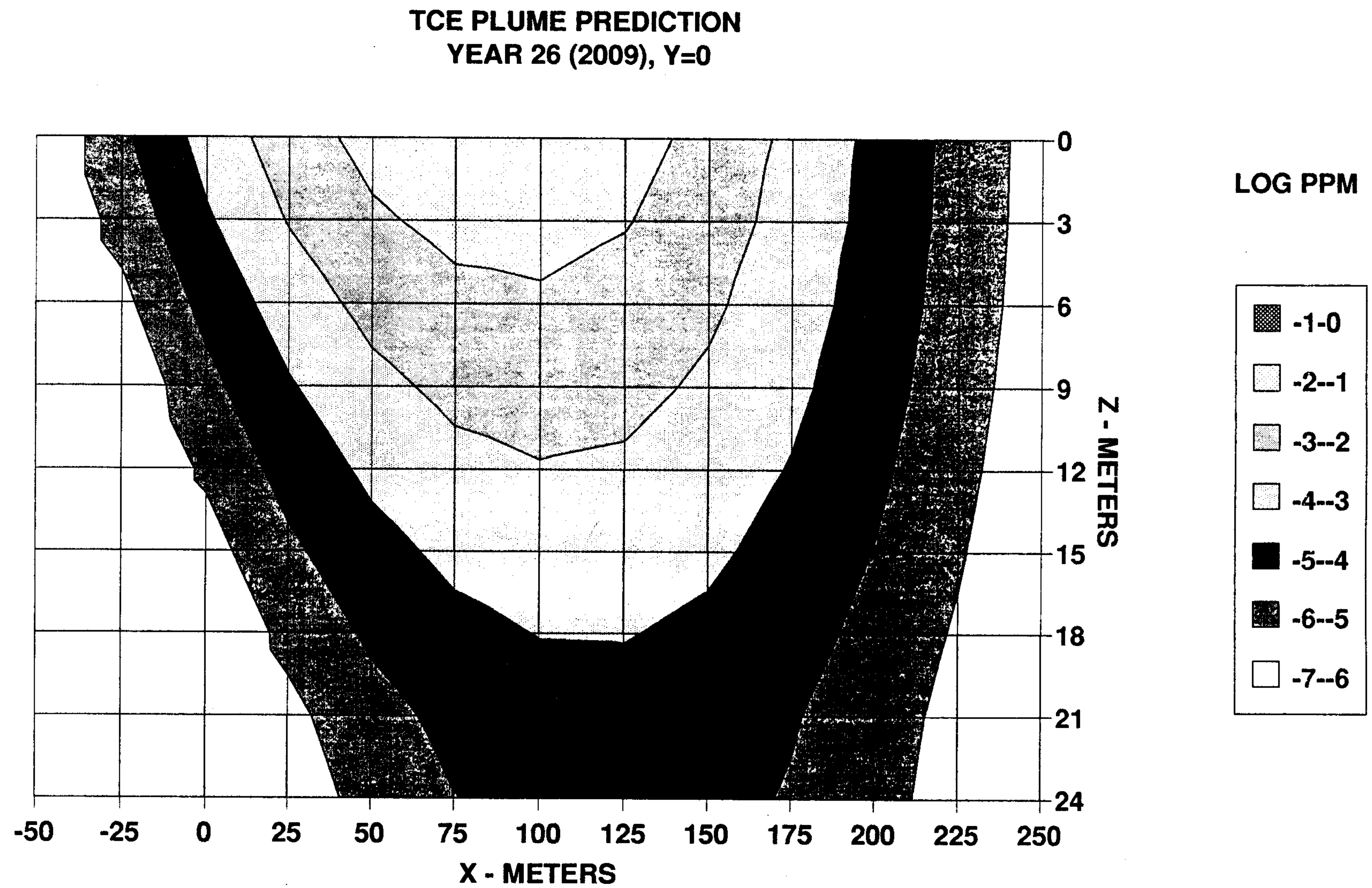
-8--7

TCE PLUME PREDICTION
YEAR 11 (1994), Y=0




TCE PLUME PREDICTION
YEAR 26 (2009), Y=0
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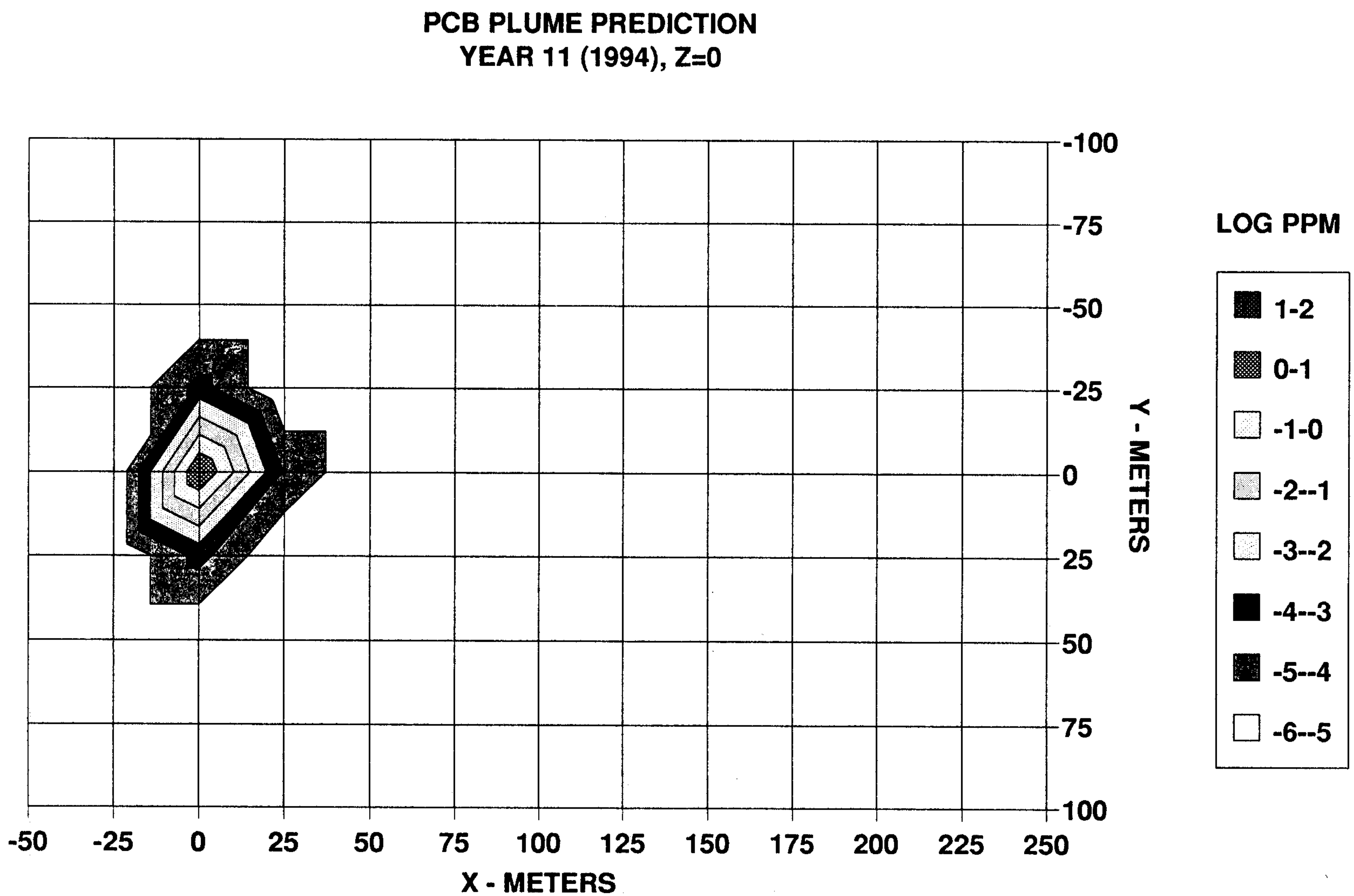
3
6
9
12
15
18
21
24
Z - METERS
-50
-25
0
25
50
75
100
125
150
175
200
225
250
X - METERS
LOG PPM
-1-0
-2--1
-3--2
-4--3
-5--4
-6--5
-7--6



PCB PLUME PREDICTION
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25
50
75
100
Y - METERS
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-25
0
25
50
75
100
125
150
175
200
225
250
X - METERS
LOG PPM
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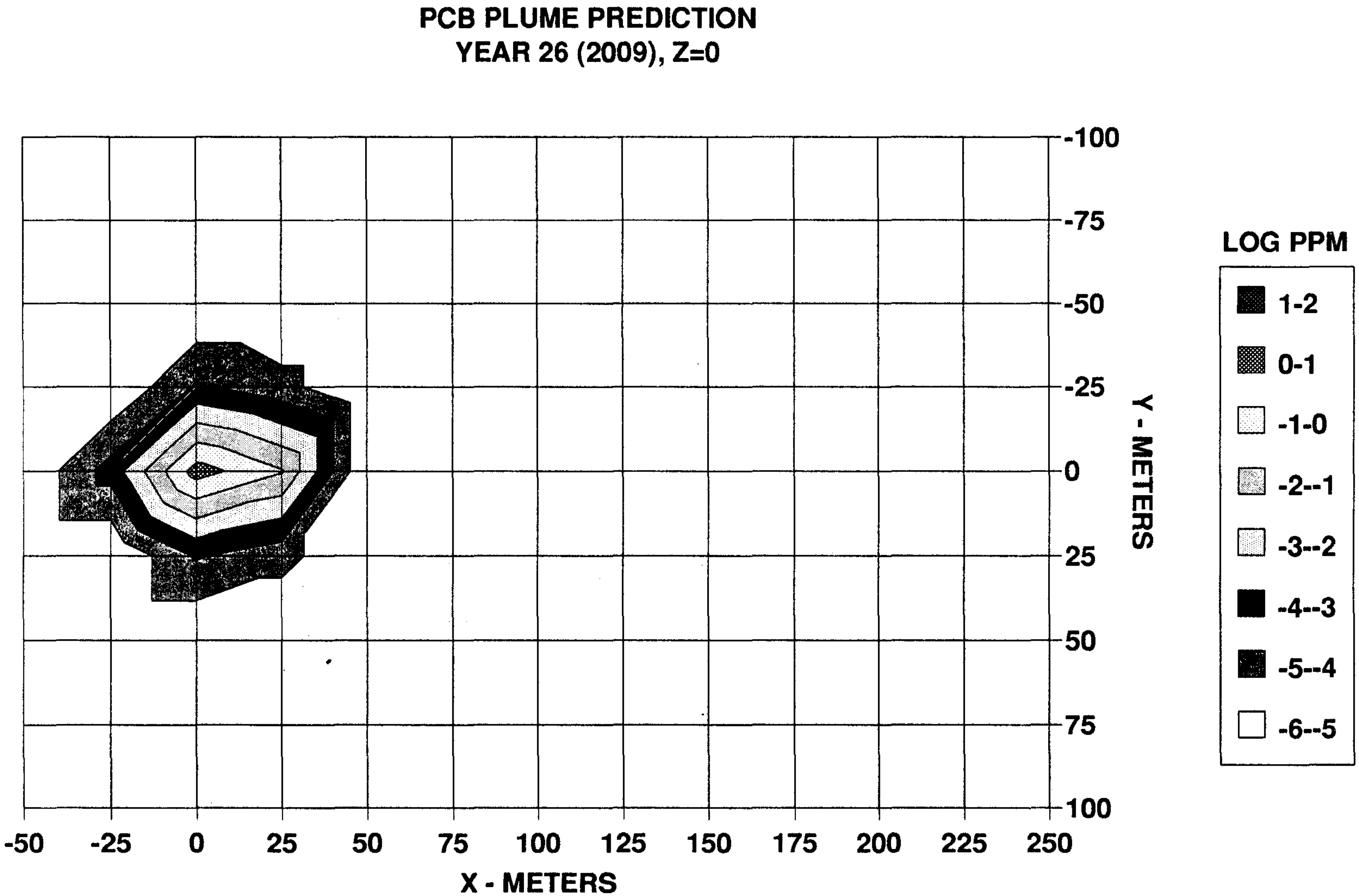
-3--2
-4--3
-5--4
-6--5



PCB PLUME PREDICTION
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Y - METERS
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25
50
75
100
125
150
175
200
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X - METERS
LOG PPM
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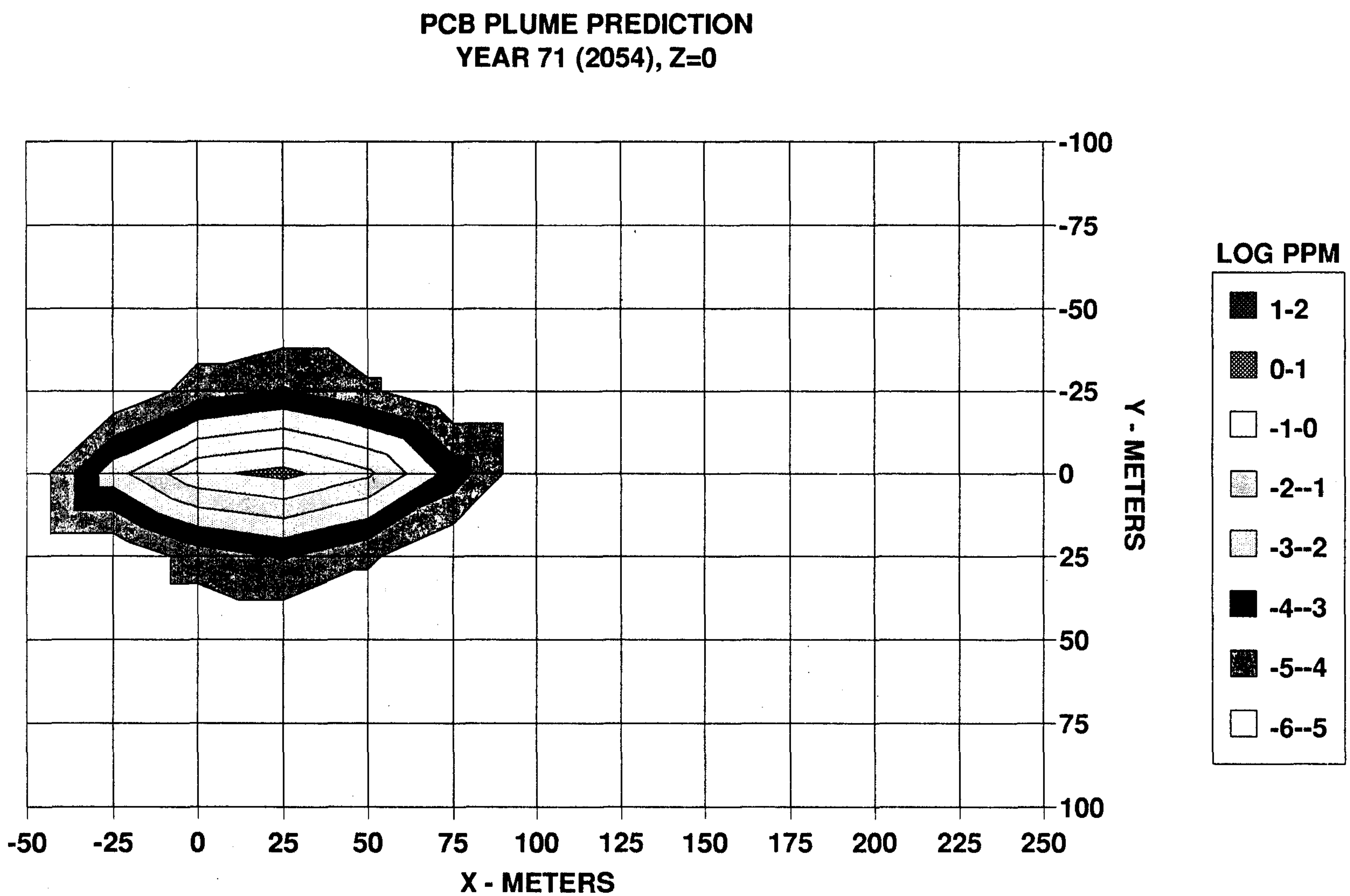
PCB PLUME PREDICTION
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-25
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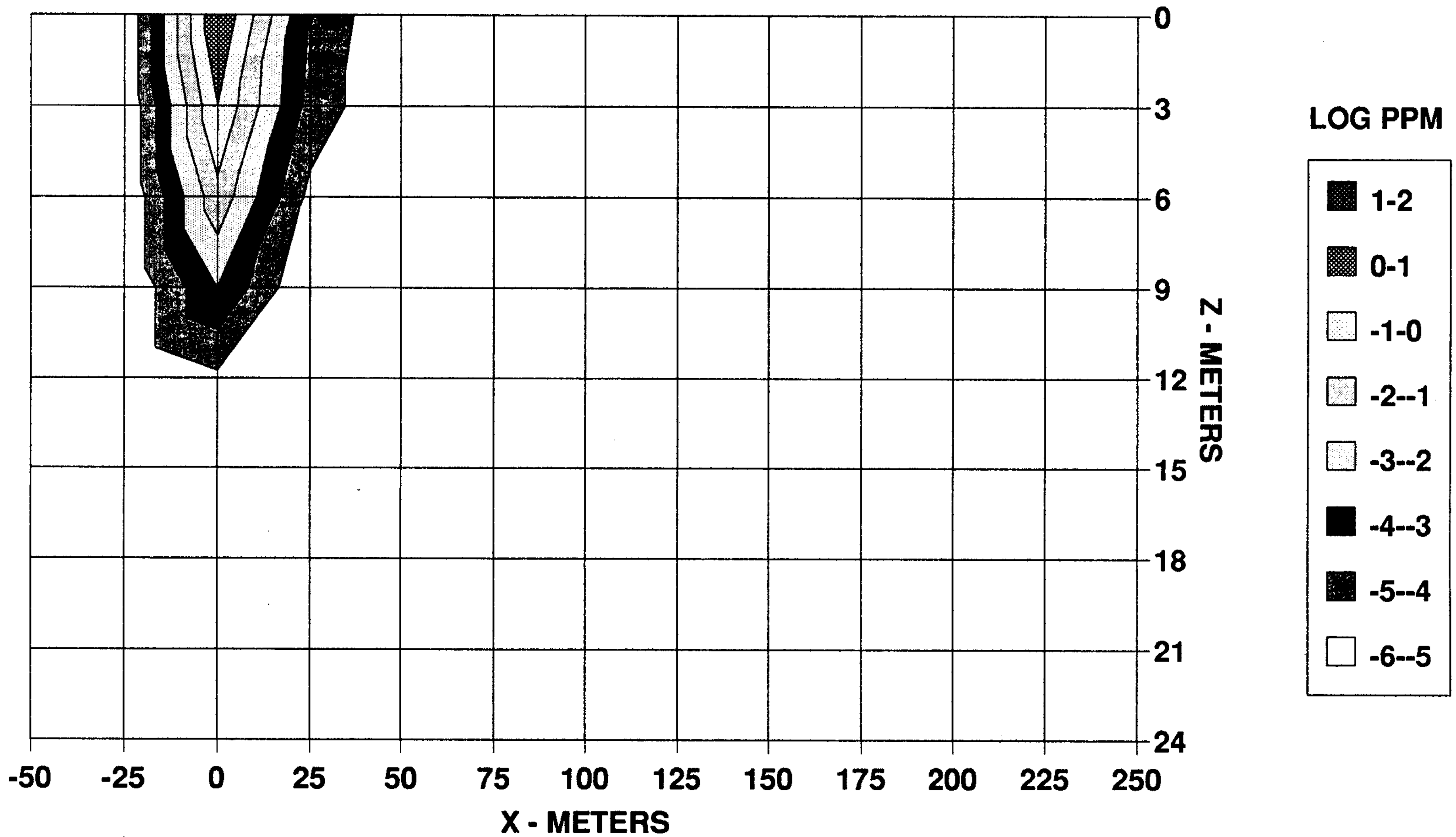
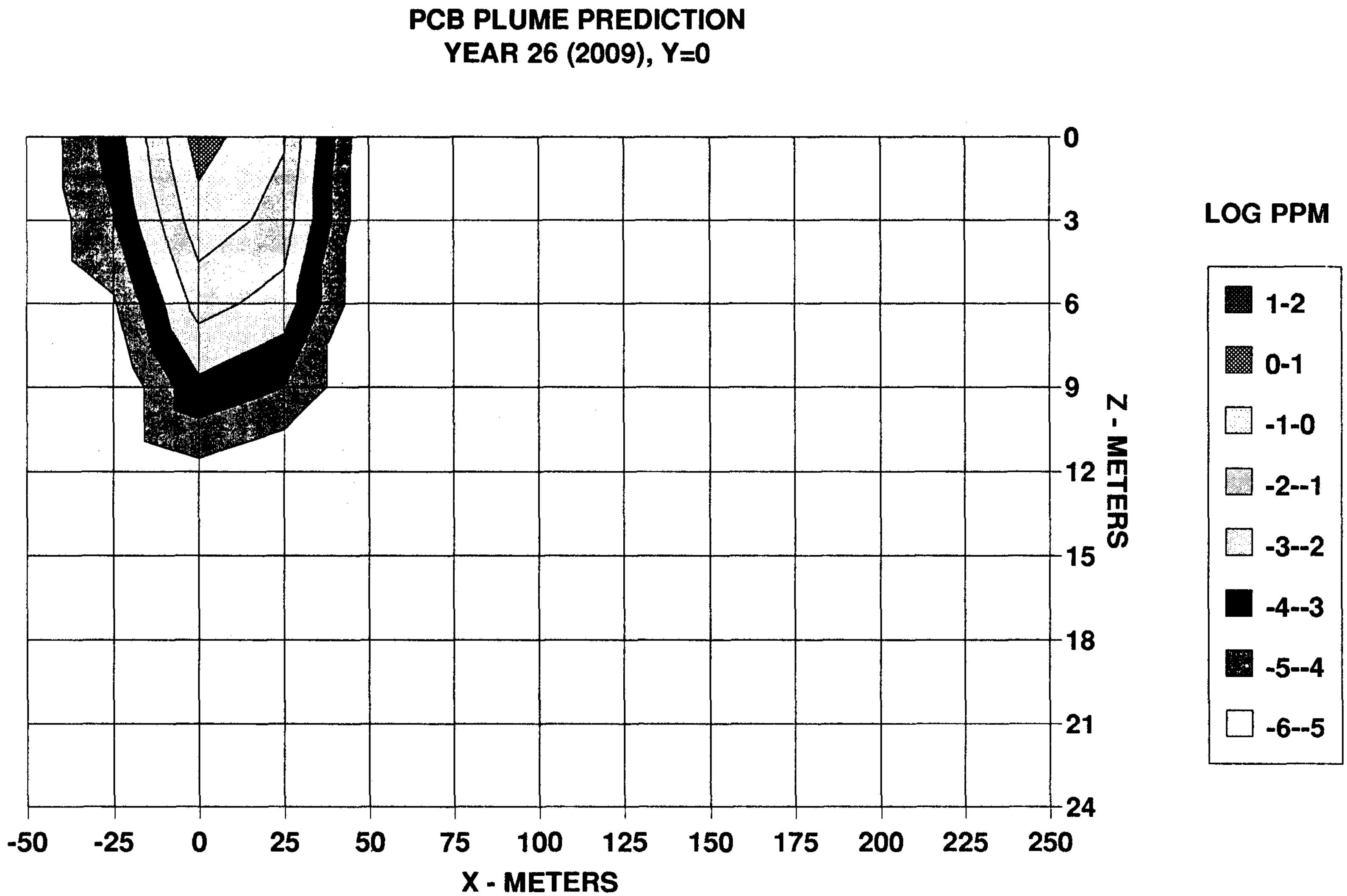
25
50
75
100
Y - METERS
-50
-25
0
25
50
75
100
125
150
175
200
225
250
X - METERS
LOG PPM
1-2
0-1
-1-0
-2--1
-3--2
-4--3
-5--4
-6--5

PCB PLUME PREDICTION
YEAR 11 (1994), Y=0




PCB PLUME PREDICTION
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12
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18
21
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Z - METERS
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0
25
50
75
100
125
150
175
200
225
250
X - METERS
LOG PPM
1-2
0-1
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PCB PLUME PREDICTION
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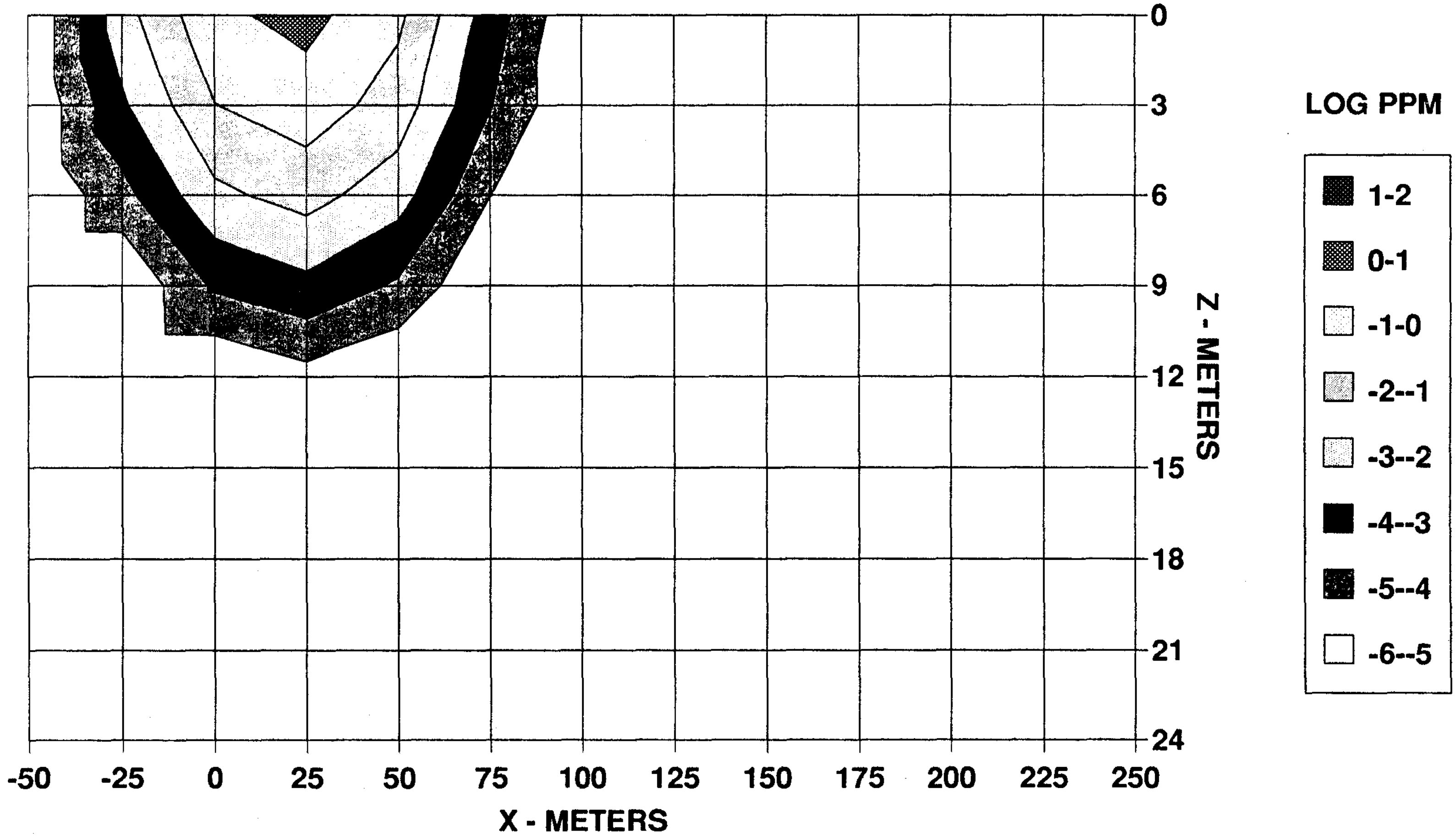

APPENDIX F

Calculations Regarding the Transport of Chemicals Due to the Flood (3/94)

The objective of the calculations was to estimate the extent of subsurface contamination by TCE and PCB based on equilibrium relationships between soil and water. From the data collected, the total mass of contaminants that were contained in the source volume (i.e., the volume of excavation) were calculated. From there, an estimation was made as to the amount of contamination that could have possibly spread due to the flood event last year. These results should only be used as a first estimate of contaminant transfer and in no way implies any type of kinetic information.

Assumptions

- Contamination is uniform across the dimensions of the excavation (12' X 10' X 50'), and this volume accounts for the source of contamination.
- Organic fraction in the soil is 1.5%.
- Soil porosity = 28% of which 25 % is water filled.
- Soil bulk density = 1.4
- During flood scenario, 50% of source contamination was affected.
- The PCBs consisted of 12.5% Aroclor 1242 and 87.5% Aroclor 1260 (1:7), and the mixture has characteristics weighted in the same ratio.
- Due to the co-solvent effect of TCE in the groundwater, PCB is 100 times more soluble than it would be in a "pure" solution.

Contaminant concentrations at the source

TCE Soil conc.(measured) = 200 ppm
TCE Water conc.(calculated) = 206 ppm

PCB Soil conc.(measured) = 200 ppm
PCB Water conc.(calculated) = = 0.072 ppm or 72 ppb

Contaminant Masses

TCE in soil = 48 kg
TCE in water = 2.5 kg
total TCE in source volume = 50 kg
(95% of the TCE is in the soil phase.)

PCB in soil = 48 kg
PCB in water = 0.85 g
total PCB in volume = 48 kg
(99.9+% of the PCB is in the soil phase.)

During the flood scenario, about 5 kg TCE and 1g PCB could have entered the groundwater at the source and been able to migrate downwards. Even at extended solubilities, PCB has an extremely high affinity for the soil phase; thus, only TCE could have migrated to any great extent. At the 60 ppm TCE action level, this represents about 84 m^3 of groundwater. High groundwater levels may have facilitated this type of transport in the past. In the soil underneath the present excavation (13' below footer) there is no obvious correlation between TCE and PCB soil concentrations.

APPENDIX G

PCB Risk Calculations

Exposure to Groundwater

Based on exposure at closest off-site access

Total Exposure = Intake from ingestion of water
+ Intake from inhalation of volatiles from water

Exposure Assumptions:

Concentration in ground water at point of exposure (C)	0.0000111	mg/L
Carcinogenic Slope Factor , inhaled (SFi)	NA	
Carcinogenic Slope Factor , oral (SFo)	7.7	(mg/kg-day)-1
Adult Body Weight (BW)	70	kg
Averaging Time (AT)	70	year
Exposure Frequency (EF)	350	days/year
Exposure Duration (ED)	30	years
Daily in-door air inhalation rate (IRa)	15	m3/day
Daily water ingestion rate (IRw)	2	L/day
Volatilization factor (K)	0.5	L/m3

$$\text{Total Risk} = \frac{EF \times ED \times C \times \{ (SFo \times IRw) + (SFi \times K \times IRa) \}}{BW \times AT \times 365 \text{ days/year}}$$

TOTAL RISK FROM GROUNDWATER = $\boxed{1.00E-06}$

Since no value for SFi exists, the (SFi x K x IRa) statement in the above equation is equal to 0 as per EPA guidance.

SENSITIVITY ANALYSIS FOR PCB IN WATER

Conc. (ppb)	Risk
0.01	9.04E-07
0.5	4.52E-05
1	9.04E-05
2	1.81E-04
5	4.52E-04
10	9.04E-04
100	9.04E-03
1000	9.04E-02